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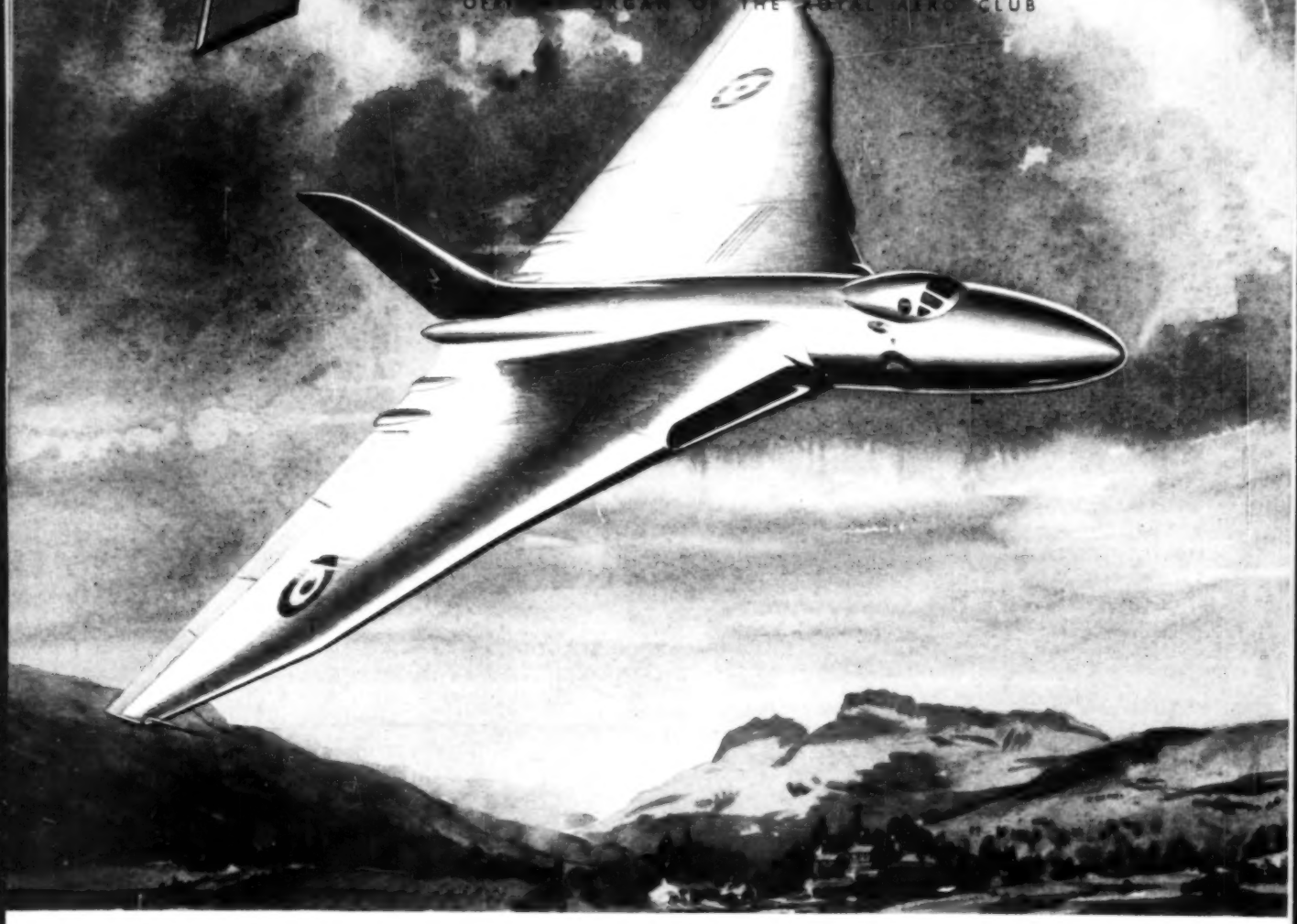

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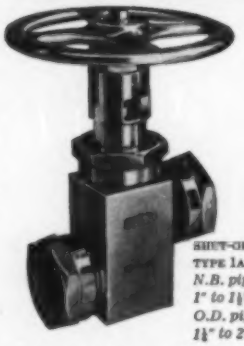

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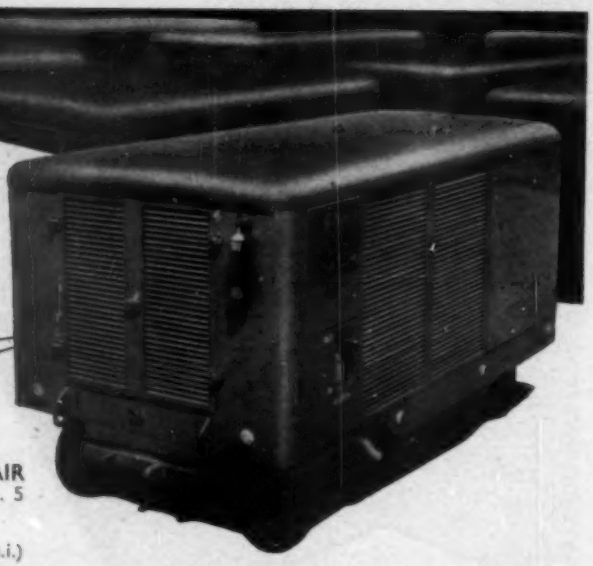

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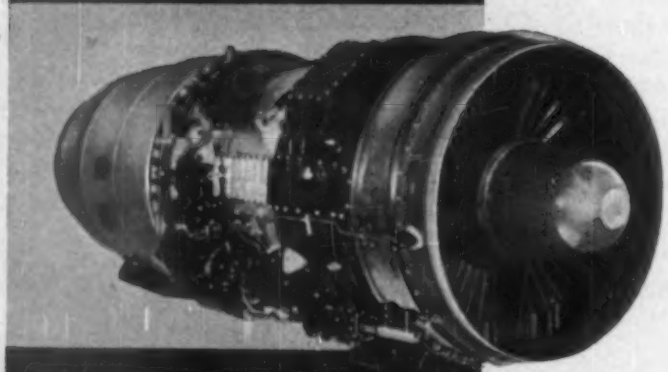

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and
AIRCRAFT ENGINEER

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What is a Passenger ?

IT took the recent debate on economy-class catering to drive home the fact that, in the airline business, things are not always what they seem. For instance, there was the transatlantic "sandwich," a cold collation piled luxuriantly upon invisible but allegedly existent bread. Superficially it appeared as a harmless joke to be poked at the noses of those commanding the airline industry; yet on a deeper level it stood as a symbol of irresponsible extravagance which, unbridled, could have wrought great damage among the world's airlines.

Equally resounding repercussions can follow a misunderstanding of the term "passenger." Bodies such as I.C.A.O. have amassed a mountain of relevant statistics, among the most significant findings being that 60 per cent of the world's air "passenger" traffic is carried less than 1,200 miles, and that the average "passenger" journey is about 585 miles. Upon evidence such as this has been developed a glowing case for the short- and medium-haul airliner.

Suppose for the moment that, of the world's 87 million air passengers, 58m flew an average of 150 miles and the remaining 29m flew 1,500 miles. Short-haul protagonists might claim that their aircraft would then cater for two-thirds of world traffic. Yet in *passenger-miles* their share would be only one-sixth. Again, a passenger is usually defined in air-transport terminology not as "a person taking a journey" but as "a person boarding an aircraft." Every time he changes from one service to another he becomes a curious statistical fiction—two passengers. As a result of this mathematical witchcraft the number of "passengers" is considerably overstated, while their average journey-distance is much greater than shown.

Evidence can be found on page 30 of this issue. According to a staff analysis based on the latest Board of Trade statistics, the average distance covered by passengers flying to and from the United Kingdom is over 900 miles. Even more significantly, two-thirds of the total passenger-mileage involved is represented by persons travelling over 1,000 miles.

Whether or not Britain's foreign-traffic experience is typical, there remains a powerful case for a reappraisal of passenger statistics. The first analyst who sits down and makes allowance for passengers being counted twice or more, and then relates the number of journeys to distance, will do the industry a very great service.

Operational Requirement

A CERTAIN well-known secret operational requirement calls for a Canberra replacement that will fly supersonically at altitude or "very fast" at sea level. The "greatest possible flexibility" is demanded of it; and it must be able to function under all weather conditions in either the strike or the reconnaissance role. Further, this paragon must possess short-field capabilities (VTOL has been suggested); and it must be available for service between 1965 and 1970.

With lean years threatening it is hardly surprising to learn that nine different tenders to this "O.R." have been submitted by the industry. Of these, declares the *Daily Express*, a design jointly submitted by Short Brothers and English Electric is "strongly favoured." All that the R.A.F. needs now, declares the Assistant Chief of the Air Staff (Operational Requirements), is the all-clear to go ahead and develop it.

But, as the A.C.A.S. himself pointed out at the R.A.F. conference Prospect Two, circumstances change rapidly. They do indeed change; and, he might have added, they can *be* changed—not only by supervening Government policy, but by the availability of aircraft having their own claims to consideration. In this instance there are two—Blackburn's NA.39 and Hawker's P.1121 (the structure of which is now over 90 per cent complete but which is never likely to fly unless ordered by one Government or another).

Whether either of these will ever bear R.A.F. roundels; whether the R.A.F. will eventually get what it at present demands; or whether some alternative requirement will be formulated in the long years that lie between is a matter that will exercise the planners and interest the public in the coming months.

FROM ALL QUARTERS

Prince Philip Flies a Vulcan

ON Tuesday of last week the Duke of Edinburgh made a 40-minute flight in a Bomber Command Vulcan, starting from R.A.F. Station Wyton, Huntingdonshire, and landing at Farnborough. With W/C. Frank Dodd (C.O. of No. 230 O.C.U., Waddington) as captain, he occupied the co-pilot's seat and took over on several occasions.

The flight followed a tour of the station, during which the royal visitor inspected the three types of V-bomber, Valiant, Victor and Vulcan, and gave the order for a scramble of five Valiants of No. 543 Sqn. He then entered XA900, and W/C. Dodd went through the cockpit check with him. Taking off, the Vulcan made a maximum-rate climb to 40,000ft, followed by a run at over 600 kt. A simulated atomic-bomb attack on R.A.F. Station Andover ensued, involving a maximum-rate turn away from the target area and a fast let-down to Farnborough, where the aircraft made a demonstration radar-controlled approach and landing.

The Duke, who had piloted a Naval Whirlwind from Buckingham Palace to Wyton, later returned in it to London.

KC-135 Atlantic Records

ON June 27 four Boeing KC-135 tankers from the U.S. Eighth Air Force headquarters at Westover A.F.B., Mass, were detailed to fly non-stop to Brize Norton, Oxon, as a routine training mission. It was expected that they would easily capture both the eastbound and westbound records for the North Atlantic. Unfortunately, the third aircraft to leave crashed shortly after take-off, and all fifteen on board—including six journalists, two members of the National Aeronautic Association and Brig-Gen. Donald Saunders, commander of the 57th Air Division—were killed. The fourth aircraft did not take off.

The two KC-135s which completed the mission flew eastbound in times of 5 hr 27 min 42.8 sec (630.2 m.p.h.) and 5 hr 29 min 37 sec (626.5 m.p.h.) thus clipping some 50 min off the three-year-old figure set up by Messrs. Hackett and Moneypenny in a Canberra.

The first tanker returned to New York (Floyd Bennett Field) on the afternoon of the same day in a time of 5 hr 51 min 28.4 sec; the other over-flew Idlewild and went on to Westover in a total elapsed time of 5 hr 53 min 30 sec.

S.B.A.C. Officers

THE council of the S.B.A.C. have elected Mr. A. F. Burke, O.B.E., as President of the Society for 1958-59, with Sir George Dowty as Vice-President. Mr. C. F. Uwins, O.B.E., A.F.C., who was President in 1956-58, becomes Deputy-President. Sir Frederick Handley Page, C.B.E., was re-elected Treasurer.

Mr. Burke is chairman and managing director of the de Havilland Aircraft Co., Ltd., chairman of the de Havilland Engine Co., Ltd., and deputy chairman of de Havilland Holdings, Ltd. He is also on the Board of de Havilland Aircraft, Inc. (U.S.A.). He has been a member of the Council of the Society since 1946. Sir George Dowty is chairman and managing director of the Dowty Group of companies, chairman of eleven subsidiary companies and a director of Remploy, Ltd. The original company, Aircraft Components, Ltd., was founded by him in 1931. He was president of the Royal Aeronautical Society for 1952-53 and in 1955 was awarded the R.Ae.S. Gold Medal for the Advancement of Aeronautical Science. Mr. C. F. Uwins is a deputy chairman of the Bristol Aeroplane Co., Ltd., a director of Bristol Aircraft, Ltd., and a director of the Bristol Aeroplane Co. (Australia), Pty., Ltd.

Membership of the Council for 1958/59 is as follows:—

Ordinary Members: Mr. J. J. Parkes, Alvis, Ltd.; Mr. H. T. Chapman, Armstrong Siddeley Motors, Ltd.; Mr. H. M. Woodhams, C.B.E., Sir W. G. Armstrong Whitworth Aircraft, Ltd.; Mr. F. Bates, Auster Aircraft, Ltd.; Mr. E. Turner, Blackburn and General Aircraft, Ltd.; Mr. J. D. North, Boulton Paul Aircraft, Ltd.; Mr. C. F. Uwins, O.B.E., A.F.C., Bristol Aircraft, Ltd.; Sir Reginald Verdon Smith, J.P., Bristol Aero-Engines, Ltd.; Mr. A. F. Burke, O.B.E., The de Havilland Aircraft Co., Ltd.; Mr. H. L. Buckingham, The de Havilland Engine Co., Ltd.; Sir Ralph Sorley, K.C.B., O.B.E., D.S.C., D.F.C., de Havilland Propellers, Ltd.; Sir George Dowty, Dowty Equipment, Ltd.; The Viscount Caldecote, D.S.C., English Electric Co., Ltd. (Aircraft Division); Mr. H. G. Nelson, English Electric Co., Ltd. (Guided Weapons Division); Mr. G. W. Hall, The Fairey Aviation Co., Ltd.; Mr. W. E. W. Petter, C.B.E., Folland Aircraft, Ltd.; Mr. H. Burroughes, Gloster Aircraft Co., Ltd.; Sir Frederick Handley Page, C.B.E., Handley Page, Ltd.; Mr. G. C. D. Russell, Handley Page (Reading), Ltd.; Sir Frank Spencer Spriggs, K.B.E., Hawker Aircraft, Ltd.; Mr. W. A. Summers, C.B.E., Hunting Aircraft, Ltd.; Mr. H. Sammons, C.B.E., D. Napier and Son, Ltd.; Sir Roy Dobson, C.B.E., J.P., A. V. Roe and Co., Ltd.; Mr. W. T. Gill, Rolls-Royce, Ltd.; Mr. J. D. Pearson, Rolls-Royce, Ltd.; Mr. A. A. Rubbra, Rolls-Royce, Ltd.; Capt. E. D. Clarke, C.B.E., M.C., Saunders-Roe, Ltd.; Mr. B. Bezall, Scottish Aviation, Ltd.; Rear Admiral Sir Matthew Slattery, C.B., Short Bros. and Harland, Ltd.; Mr. R. P. H. Yapp, Vickers-Armstrongs (Aircraft), Ltd., (Supermarine); Mr. T. Gammon, O.B.E., Vickers-Armstrongs (Aircraft), Ltd. (Weybridge); Mr. E. C. Wheeldon, Westland Aircraft, Ltd.

Associate Members: (Materials Group) Mr. H. G. Herrington, C.B.E., Mr. C. E. Holmstrom; (Equipment Group) Mr. F. Rowarth, Mr. T. C. L. Westbrook, C.B.E., and one other to be appointed by the Equipment Group Committee.

COLEOPTERE: The first picture of the new SNECMA development of the Atar Volant. Powered like its precursor with a SNECMA Atar turbojet, it is shortly to undergo preliminary trials piloted by Auguste Morel. Aircraft of the "Coleopter" type are foreseen for a variety of civil and military purposes.

ROYAL STARTER'S ORDERS: The Duke of Edinburgh at R.A.F. Wyton, Hunts, after he had "scrambled" five Valiants during his visit on June 24 (see item in Col. 1). With him (holding a stop watch) is the station commander, G/C. E. G. Jones, and on the left is the A.O.C.-in-C. Bomber Command, Air Chief Marshal Sir Harry Broadhurst. The time-to-airborne—described as "the best yet"—was 6 min 59 sec.

R.A.F.A Displays

HIGHLY successful R.A.F.A. displays were held at Exeter Airport (by the Association's South-Western Area) and at Staverton Airport (Midlands Area) last Saturday, June 28. Correspondents report as follows:—

The R.A.F.A. Display at Exeter Airport was the best seen in the West for years. A. Cdre. Sir Frank Whittle declared it open, under dark skies—later to turn into a glorious afternoon. Three members of the Tiger Club took off in vic, with the "Bishop" in the box. After two tethered runs the "Bishop" swung away for superlative aerobatics. The C.F.S. Jet Provost team put on their own splendid show and two Bristol U.A.S. Chipmunks performed faultlessly. Exeter Airport themselves staged a demonstration—by No. 3 Civil Anti-Aircraft Co-operation Unit—in which a Vampire 5 and a Mosquito TT.35 were followed into the air by nine Balliols, in formation, the Mosquito returning to demonstrate drogue streaming and dropping. For the final run it led two Balliols, with the Vampire in the box, the Balliol formation then making a stream landing.

From two Plymouth Aero Club Tigers two club members (Lucas and Lang) made a formation parachute descent.

A C.F.S. Vampire T.11 (F/L. R. Holloway) put on an aerobatic show expected of a champion, giving way to four Gannets of No. 796 Sqn. (Lt-Cdr. L. Searson). Four Sea Venoms (Lt-Cdr. Sinclair) swept in streaming paraffin, and one broke off for aerobatics before rejoining for a combined display, including dummy deck landings. The U.S.A.F. took a hand with a KB-29P and a KB-50J trailing three hoses.

Bomber Command presented a No. 35 Sqn. Canberra (F/L. E. K. G. Bates), a No. 207 Sqn. Valiant (F/L. E. A. Jackson Crook) and a Vulcan (F/L. R. A. Streatfield), which streamed black trails as it swept in from the east in a fast run. Fighter Command's contribution was high-speed aerobatics by Hunter F.5s of No. 56 Sqn. (S/L. R. J. S. Dickinson)—this being the first time in the West that the public have seen a Hunter squadron team in action. There was an equally good show by a Hunter (F/O. J. McEwan), of No. 2 Sqn. of the Hunter O.C.U., Chivenor. While Westland's civil Whirlwind was duly whirling, two Tiger Moths were busily climbing for a second delayed drop by Messrs. Lucas and Lang. Finally, Sgt. "Andy" Gough delighted everyone with sailplane aerobatics.

At Staverton the eighteen items had a clockwork precision. Even the cancellation of a helicopter demonstration did not mar the proceedings—thanks to F/L. J. H. Kingsbury in a Tiger Moth of the C.F.S. Flying Club. The display was most admirably organized by the Midland Area of the R.A.F.A., and the day was dry, after a week of "mid-winter" storms.

The first item gave Club members a chance to show off their aircraft; and they were followed by a Canberra and a Vulcan. As the Vulcan left the circuit S. Smith and Sons' attractive Dove took off, with Mr. R. Palmer at the controls, for asymmetric flying. The one-and-only Gloster Gladiator still flying was beautifully demonstrated by Geoff. Worrall. His wing-waving to the crowd at nought feet as he bade farewell was one of the chummiest gestures seen at a display for a long time. When Sycamore winching by F/L. R. Smith was concluded, the parachute team had reached altitude and position. Three parachutists, Sue Burgess, Tony Miller and Dave Hall, floated gracefully down in formation, each with a banner streaming, landing on the grass a few yards from the spectators. Sue Burgess later did a solo delayed drop. Chipmunks of Bristol U.A.S. put on a merry "instructor and pupil" act, aided and abetted by the commentator, and F/L. A. T. Morgan demonstrated just what could be done with an Olympia sailplane.

The Valiant and Vampire (see Exeter report) and a No. 56 Sqn. Hunter were followed by four Javelins of No. 23 Sqn., in box, line-astern and echelon. A KB-50 tanker flew past twice very low, with tail and wing-tip hoses trailing, and the C.F.S. and 56 Sqn. teams rounded off a wonderful day—for a wonderful cause.

Sir Harry Broadhurst's Flight

SINCE our "Service Aviation" page (p. 25) closed for press further details have become available of Air Chief Marshal Sir Harry Broadhurst's flight by Vulcan to Rhodesia. The first stage, 1,943 st. miles from R.A.F. Waddington, Lincs, to overhead El Adem, was flown in 3 hr 9 min, an average speed of 617 m.p.h. El Adem to Embakasi, 2,530 st. miles, was reported to have been covered in 3 hr 58½ min (637 m.p.h.); these last two figures are estimated. Overall flying time from Waddington to Salisbury was 9 hr 7 min, giving 606 m.p.h. The Vulcan was captained by W/C. Frank Dodd, C.O. of No. 230 O.C.U.

Druine Turbi Plans

A COMMENT in our report on the very successful Popular Flying Association rally at Rhoose on June 14—that plans of the Druine Turbi "left a good deal to the imagination"—has drawn a sharp protest from Harold Best-Devereux, who is the United Kingdom agent for Société Avions Roger Druine. In echoing amateur builders' reactions to the Druine Turbi drawings, this comment was not intended to imply that the aircraft was anything but an excellent design for amateur construction; nor, of course, was it *Flight's* intention to have caused any hurt to Madame Druine, widow of the Turbi designer, Roger Druine—who, as Mr. Best-Devereux rightly declares, died virtually a martyr to the cause of ultra-light aviation. We hasten to express our sincere regrets at any distress that may have been caused.

Mr. Best-Devereux points out that the French philosophy in amateur plans is that the constructor must *think*, though this does not imply that any essential information is missing. As amateur constructors in this country will freely acknowledge, spare-time aircraft building is not a task to be undertaken lightly. The ideal for which designers strive is to make engineering drawings as clear and unambiguous as possible, and home constructors in particular may expect to be generously treated in this respect.

Construction groups in this country have received much help and advice from Mr. Best-Devereux and from the Popular Flying Association—champions of amateur construction.

Backed by the enthusiastic assistance of the P.F.A., the sale of drawings of this design represents perhaps the biggest step towards large-scale amateur construction of a robust and serviceable aircraft ever undertaken in the United Kingdom.

Sir Roy Succeeds Sir Frank

ON Thursday of last week Sir Thomas Sopwith, chairman of the Hawker Siddeley Group, Ltd., announced: "Sir Frank Spriggs, K.B.E., has by mutual agreement relinquished his appointment as managing director of the company and has been succeeded by Sir Roy Dobson, C.B.E." Sir Thomas added the following personal statement:—

"Sir Frank Spriggs has been an intimate associate and friend of mine for more than 44 years and for the past 23 years served as managing director of Hawker Siddeley. He has played a vital part in the development of British aviation and will always be considered one of the great figures of the industry.

"The country has reason to be thankful for his foresight and planning. It was Sir Frank who backed the Hawker Hurricane as a private venture—giving instructions in 1936 for 1,000 Hurricanes to be jigged, tooled and manufactured without Government support. This bold decision was instrumental in winning the Battle of Britain.

"In recent years, Sir Frank has had to stand up to increasing demands and complex problems resulting from changes brought about in the aircraft industry—developments which have resulted in Hawker Siddeley changing from a largely aviation concern to a great industrial enterprise with many diverse interests.

"I, personally, am deeply sorry that so long and fruitful a business association has come to an end, and I hope that his health will benefit from being relieved of these great burdens."

In a newspaper interview last week, Sir Frank said:—

"I have been in the very front of the aircraft industry for 44 years and through two world wars. I believe that after that I deserve a holiday. I am looking forward to a good rest. If I had left the break much longer I would not have been able to enjoy retirement."

Sir Frank said that the position of his brother, Mr. A. Neville Spriggs, as managing director of Hawker Aircraft, was not affected. "He is doing a good job there," he added.

Sir Roy Dobson, the new managing director, is a director of the Group, managing director of A. V. Roe and Co., Ltd., and chairman of A. V. Roe Canada, Ltd. One of the best-known figures in the industry, Sir Roy will no doubt be remembered in later years chiefly for his quantity production of the Avro Lancaster in World War 2, and subsequently for his association with its latter-day successor, the Vulcan. One of Sir Roy's major tasks during the past few years has been development of the Group's interests in Canada.

IN BRIEF

The Bristol Olympus Mk 200—rated at 16,000 lb thrust—flew for the first time on June 20, installed in an Avro Vulcan B.1, from Langar, Notts. It is the powerplant for the Vulcan B.2.

* * *

The first Sage computer group went into 24-hour operation last week for the defence of the continental United States. Two computers each cover some two acres of ground and receive and correlate signals from several chains of early-warning radar systems. Control is exercised from ConAD H.Q. at Colorado Springs.

* * *

Following inspection of the aircraft at Croydon last July, the A.R.B. has now accepted the Super Aero light twin for British validation of its Czech C. of A. Certain modifications were requested, including provision of a direct-vision panel in the windscreen and a stall-warning indicator. The latter equipment has also been stipulated by the A.R.B. in the case of a number of British light aircraft. U.K. sole agents for the Super Aero are Aircraft and General Finance Corporation, Ltd.

* * *

A Bristol Sycamore is being used by John Laing and Son, Ltd., contractors for the London - Yorkshire Motorway, to provide a rapid means of communication for the project general manager, Mr. John Michie. Piloted by Bristol helicopter test pilot Bob Smith, the helicopter is able to take Mr. Michie from his headquarters at Newport Pagnell on a tour of inspection in an hour and a half—whereas by car the survey would take the better part of four days.

SKEETER'S BIG BROTHER: The new Saunders-Roe P.531 five-seat helicopter (Blackburn Turboméco Turmo gas turbine), which has recently started initial ground running at Eastleigh with a slave engine. The makers expect the first flight to take place in the near future.

Meeting des Nations

NATO DISPLAY AT LIÉGE

"FLIGHT" PHOTOGRAPHS

THE weather was almost kind to the seven formation-aerobatic teams at the NATO display at Liége last Sunday; and, though it had tried hard, it could not prevent the arrival of King Baudouin in a Sabena S-58 helicopter or the landing of four F-101C Voodoos and a KC-135 direct from Washington. The KC-135, flown most of the way by Gen. Curtis LeMay and carrying Jacqueline Cochran as passenger, made the trip non-stop in 6 hr 44 min, while the four Voodoos flew the 3,455 n.m. in 6 hr 11 min at an average groundspeed of about 515 kt. They were accompanied most of the way by their five KC-135 tankers, and refuelled three times, although one tanker abandoned the mission and another lost its boom during a refuelling period.

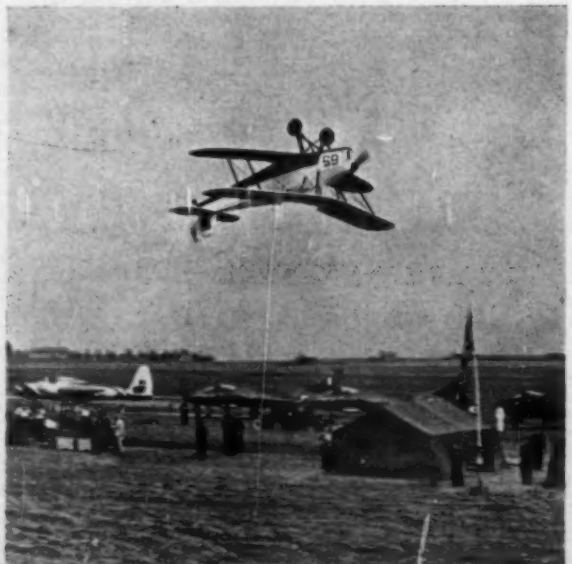
Making their European début like the Voodoos, two F-104B Starfighters came from the 83rd Fighter/Intercepter Sqn. at Westover A.F.B., but they arrived partly dismantled in C-124s. Though mainly intended as operational trainers, the 104Bs carry the Vulcan six-barrel cannon and Sidewinders. The latter can fire blind using the Lockheed-designed, General Electric-produced AN/ASG-14T1 search-and-tracking radar, but they fire their Vulcan either by visual sight or with an infra-red sight integrated with it. They carry 908 U.S. gal of fuel internally, have V.O.R., A.D.F. and I.L.S. for navigation as well as a data-link system; and each squadron is supplied by Lockheed with a man only four feet tall to climb into the intakes past the fixed shock cones and inspect the engine face for foreign-object damage. Later models will have a suitably placed inspection door. Touch-down speeds around 150 kt are common, though take-off flap and gear can be left extended up to 296 kt. Tyres last for about 25 landings. For a pilot used to F-86s, the F-104 really "takes the breath right out of you," both in acceleration and level speed. And it trails a population-disturbing shock-wave across the ground when flying supersonically at high altitude.

The U.S. Navy also made a "pitch" at the Liége show. From the eastern Mediterranean, *Essex* sent an A4D-2 Skyhawk with refuelling boom and latest trimmings, and an FJ-3 Fury. *Saratoga* sent an immaculate A3D-2 Skywarrior, an F3H-2N Demon with semi-retractable refuelling boom and an F8U-1 Crusader with fully retracting boom and a shoe for a Sidewinder on each flank of the forward fuselage. In fact, all the operational U.S.A.F. and U.S. Navy aircraft at Liége were fitted to fire air-to-air or air-to-ground missiles, except a C-124 and three C-130 Hercules—which are only capable of transporting such stores. The R.A.F. was represented by Hunters, a Shackleton 3 of No. 206 Sqn., a Valiant of No. 7 Sqn., a Vulcan of No. 83 Sqn. and, unofficially, by a Chipmunk. France sent a Taon, Alizé, SMB2, Djinn, Alouette, Noratlas and Magister. Germany supplied a civil and a military Dornier Do 27, and Belgium the minute Tipsy Nipper. Missile "hardware" included a Nord 5103, a de Havilland Firestreak, a rather forlorn Nike Ajax on a launcher and the latest Bristol Bloodhound, painted a splendid white and mounted on its compact, remote-controlled, transportable launcher. It was stated that Bloodhound is controlled by twisting and steering with all-moving wings and that single missiles or salvos may be fired at a target "illuminated" by a single radar. Target acquisition by this radar may be instigated either from a tactical or early-warning radar station.

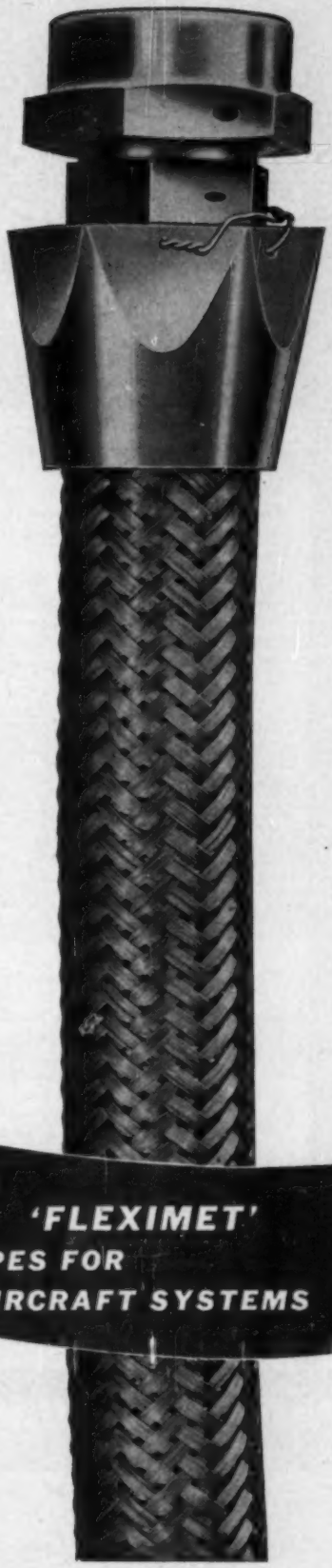
Two F-100Ds and an RB-66B refuelling from a KB-50J travelling under full six-engined (four piston, two jet) power.

Altogether twelve NATO nations joined in providing a large variety of types, from a Catalina (Denmark) to the bullet-like F-104B. Belgian parachutists jumped in groups of six and three, the latter landing accurately in an open patch the size of a tennis court after some exceedingly delayed openings. A Caudron and a Blériot got airborne and spluttered bravely about at 150ft. The Noratlas flew for some way on the power of two tip-mounted Marboré boosters with both Hercules propellers feathered. W/O. Janssens gave a superb display of classic aerobatics in a Stampe

Left, the Skyblazers over the Do 27, F-104B, Alizé and (just landed at left) an F-101C Voodoo. Right, the SV.4bis Stampe passes low near a Portuguese F-84G and Hunters from No. 93 Sqn., 2nd T.A.F., and No. 111 Sqn.—the Black Arrows.



proof against vibration or flexing in high ambient temperatures



There is an increasing need for flexible pipes capable of working in positions where they are subjected to vibration or flexing in high ambient temperatures.

Effective in temperatures minus 55° to 400°C.
Dunlop "Fleximet" pipes are all-metal assemblies developed to work in a temperature range of minus 55° to 400°C in aircraft fuel, oil and oxidant systems.

Designed for high and medium pressure ranges
They are manufactured in two types. The high pressure assemblies are extremely flexible, and are designed to work at pressures up to 6000 p.s.i. with low fluid flow. The medium range working pressures vary according to bore diameter and are capable of handling relatively high fluid flows.

Details on application
These all-metal pipes are a valuable addition to the range of conventional flexible pipes employing rubber hose already available. Further details of "Fleximet" pipes can be obtained from:—

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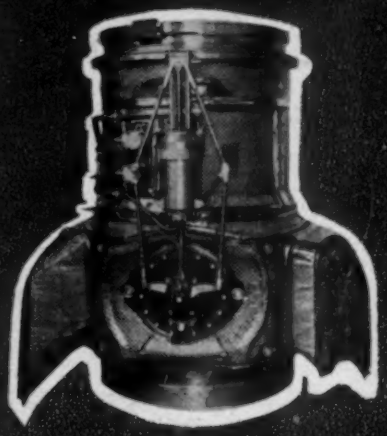
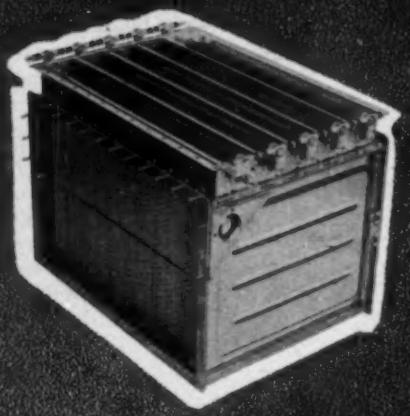


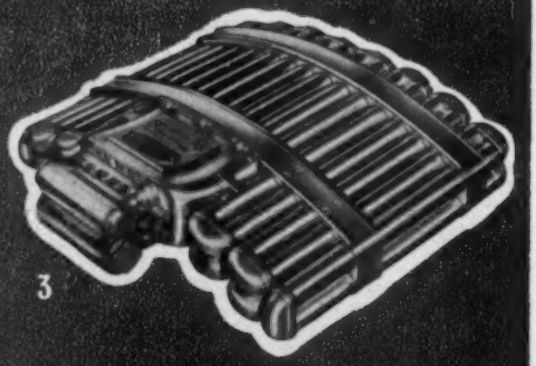
1

These thermal blankets are made of refractory fibre cased in .004 inch (.1016 mm) stainless steel. They are made-to-measure and are extremely light, the dimpled construction being responsible for their great strength. Specified for Rolls-Royce and Armstrong Siddeley jet and turbo-prop engines, these particular examples are shown fitted to the Rolls-Royce thrust reverser for the de Havilland Comet and Sud-Aviation Caravelle.



2

We design, manufacture and supply heat exchangers for many purposes in both aluminium alloy and stainless steel. This particular example is for the Vickers Vanguard's anti-icing system. Similar units are being supplied for the Fokker Friendship, the Bristol Britannia, the Armstrong Whitworth Freightliner and the Vickers Viscount.



3

High pressure fuel-cooled oil cooler for high performance gas turbine engines. This unit is used in the Armstrong Siddeley Sapphire S.A.7.

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MEETING DES NATIONS . . .

SV.4bis and then indulged in a crazy aerial ballet *cum* dog-fight with another SV.4. A Belgian Spitfire VB passed briefly.

Three of the U.S. Navy types went by in formation, leaving the fourth, the F8U Crusader, to make its own very fast pass, dumping a stream of fuel from each wing-tip the while. A Tactical Air Command KB-50J tanker flew past at full steam with an RB-66B and two F-100Ds hooked up rather like high-speed suckling piglets. Sizeable formations of Norwegian F-86s, Belgian RF-84Fs, Canadian CF-100s, Danish F-84Gs, Turkish F-84Gs and Belgian Hunters flew by at various times. Dornier test pilot Schaefer flew the Do 27 in his own inimitable and highly impressive way.

It was indeed a memorable, three-hour aeronautical free-for-all and, considering the controllers' task in handling formations from foreign air forces in heavy haze, the show went off excellently, and with very few pauses. There was a little overlapping, such as when the Dornier climbed up towards No. 111 Sqn. as they dived vertically into their bomb-burst, and when RF-84F swished by during another item. The great show ended when the Belgian Hunters made their downward bomb-burst almost at the instant that four F-84Fs came in "on the deck," biggish "bombs" began to detonate on the ground and two RF-84Fs took off steeply with the urge of four JATO bottles apiece. Seconds later another RF-84F made a drag-chute landing, bringing developed prints of air-to-ground photographs taken throughout the show. With smoke-trailing Hunters diving, rocket-boosted 84Fs climbing, others passing and earth flying from explosions, things became not only distinctly crowded but also somewhat noisy. The crowd oohed and aahed its appreciation. It seemed almost a pity that some of the staging in the grandstands had chosen a rather earlier moment to collapse.

The battle of the giants was, of course, between the seven formation aerobatic teams. There were four black F-84Gs from Greece, four strip-d F-84Gs from Portugal, the nine black Hunters of No. 111 Sqn., six red and silver F-84Fs from Italy, six F-84Gs from Turkey, the U.S.A.F.E. Skyblazers with F-100s and five Belgian Hunter F.4s. The thickish haze and troublesome cloud to some extent hampered all the teams, but a momentary drop in cloud-base forced the Skyblazers to a restricted "level show." They contented themselves with the traditional series of afterburning passes, tight turns and a few rolls. The tightness of their formation and precision of flying is still unmatched, but they now make up for a relatively inflexible performance by emitting frequent bursts of dense grey smoke which largely obscured the airfield. They had the noisiest aircraft and the densest smoke.

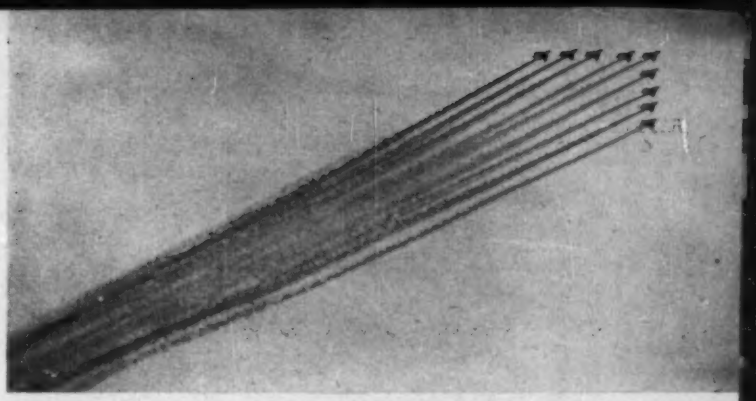
The Greeks, Portuguese and Turks were something of an unknown quantity, but the Greeks soon established themselves as masterful and smooth fliers with a good sense of showmanship and a fine repertoire of manœuvres and formation changes. The Portuguese were good showmen and, like the Greeks, made clever use of the clover leaf for positioning. Their formation changes were exceedingly crisp and their vertical upward smoking bomb-burst and cross-over expertly timed. But they did not quite achieve the performance of the Greeks. The Turks flew six F-84Gs in two vics and made one fine roll in arrow, but they left inexplicably after only a few widely separated manœuvres.

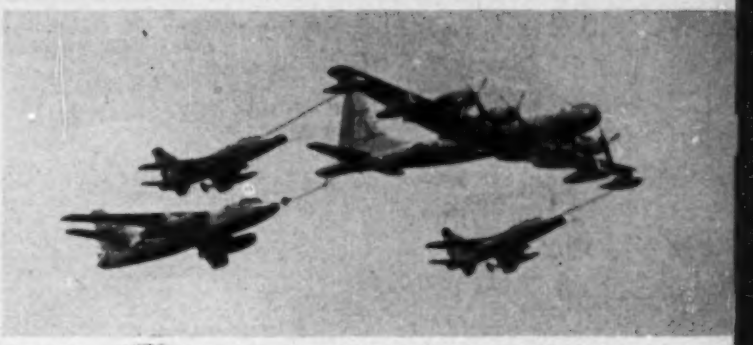
Masters of the line-abreast loop, the Belgian Hunters showed great flying skill and a crisp, varied performance with plenty of formation changing. They were practically up to the standard of No. 111 Sqn. but they did not quite maintain the pace.

Since the Skyblazers were restricted by weather, the first place was hotly contested by the six Italian F-86Fs of the Diavoli Rossi and the nine Black Arrows of No. 111 Sqn. The Italians drove their aircraft like sports cars, faster, it seemed, than any of the other teams; and they therefore vanished into cloud at the top of every vertical manœuvre. But their station keeping, variety of formation and the pace of their show left little to be desired. They took off in a ring formation, made a very fast roll and shed the sixth man to continue as a five-aircraft group. It was an exceedingly fine performance which ended in a smoking downward bomb burst followed by quite the hottest and lowest cross-over of the afternoon. They landed in card-five formation.

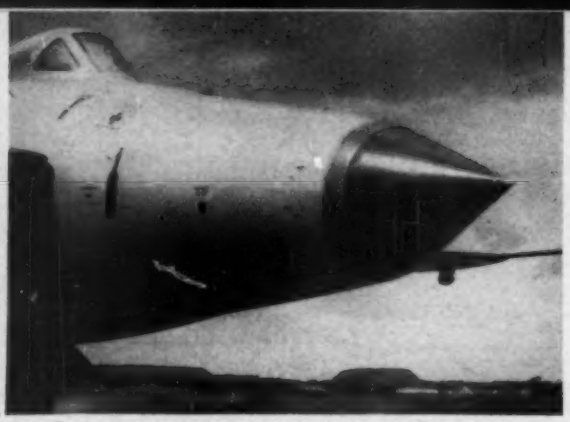
The aerobatic crown of Liége, in our opinion, went to the Hunters of No. 111 Sqn. Their loop and roll in a geometrically precise box of nine is a wonderful spectacle; the rearmost four burst out of the big formation streaming smoke to herald the beginning of the main five-man show. Manœuvre closely followed manœuvre with one or two formation changes each time, and their path was pencilled in grey smoke. Particularly interesting were the smoking roll from card-five into box and the smoking loop in line abreast. The Treble One display is unmatched for pace, timing, variety and skill.

C. M. L.





From top to bottom, nine Belgian F-84Fs stream black, yellow and red smoke as a finale for the Meeting des Nations; two F-100Ds and an RB-66B refuel from a KB-50J; the latest Bristol-Ferranti Bloodhound and launcher; the Blériot monoplane "en plein vol"; one of four F-101Cs passing a Hunter F.6 of No. 93 Sqn., 2nd T.A.F.



These photographs illustrate the Ferranti Airpass radar fire-control equipment—part of the P.1B weapon system and described below—during its development. On the left the radar is being installed in a Dakota; on the right is a special Canberra B(I).8 used for more advanced trials.

Airpass

DISCLOSURE OF FERRANTI FIRE-CONTROL SYSTEM FOR P.1B

BRIEF details may now be published of the radar fire-control system for the English Electric P.1B supersonic all-weather fighter. Developed by Ferranti, Ltd., at Edinburgh, the system is called AIRPASS (Airborne Interception Radar and Pilots' Attack Sight System) and is one of the most advanced and versatile airborne fire-control systems in the world.

At the time of the Battle of Britain—say Ferranti—ground radar was necessary to direct single-seat fighters so that they could make contact with the enemy. Today aircraft speeds and altitudes have increased vastly and longer-range weapons are available, so that unaided visual contact can no longer ensure a successful attack. It was to meet this requirement that Airpass was developed. The pilot may now never see his target and yet still destroy it.

Airpass comprises a very advanced radar and a sighting system. The former gives information to the pilot in basic, usable form, enabling him to intercept the target and lock-on. Thereafter the radar automatically tracks the target, feeding information to the sighting system for presentation to the pilot in such a way that he can quickly manœuvre into a suitable position for an attack with guns, rockets, or guided weapons. The sight ensures that all weapons are correctly aimed.

In a typical interception, ground radar will set the pilot in the general direction of the target. Airpass will then take over. Its radar beam will scan a sector of sky covering a wide angle, horizontally and vertically, and extending many miles ahead. When the target is located the radar will lock-on and a computer will calculate the best approach course. The pilot then completes his attack, using the information presented to him in his sight. Should the target come into his view he can take advantage of the visual sighting methods included in the system. An automatic warning tells the pilot when to break-off the attack should he be in danger of colliding with the target.

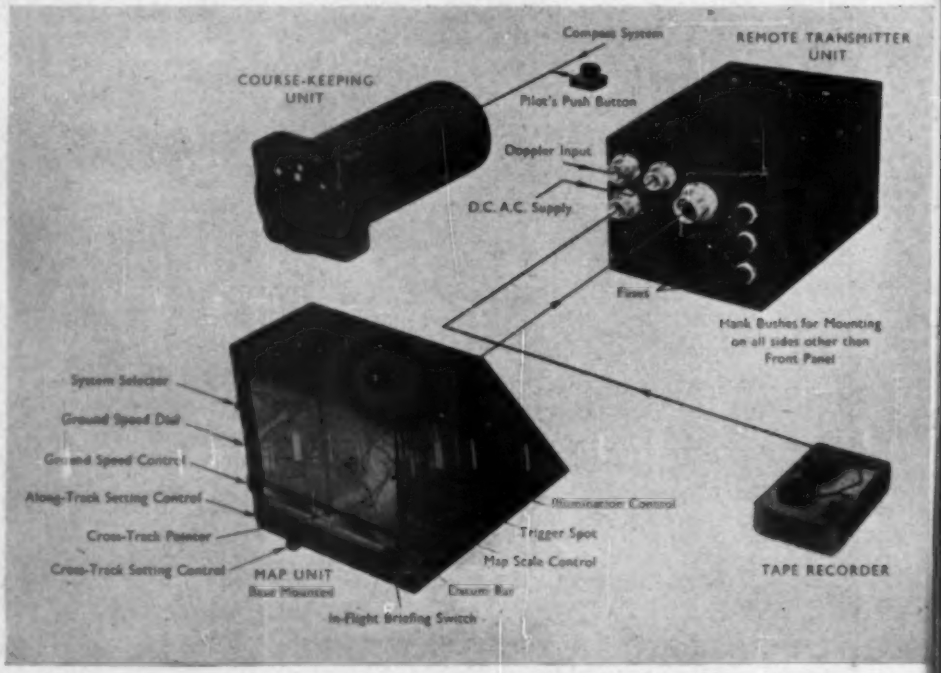
In Airpass the radar is housed in a single container, which in the P.1B forms the complete intake centre-body. In this way the P.1B carries a powerful radar equipment, without increasing frontal area unnecessarily and preserving the optimum aerodynamic form. A considerable weight-saving is effected by eliminating the usual distributed boxes and interconnecting cables, and by making the radar bullet part of the aircraft structure.

Airpass is small enough to be installed even in lightweight fighters. It has been demonstrated to senior officers of the West German Air Force and also to other Allied countries who have shown interest.

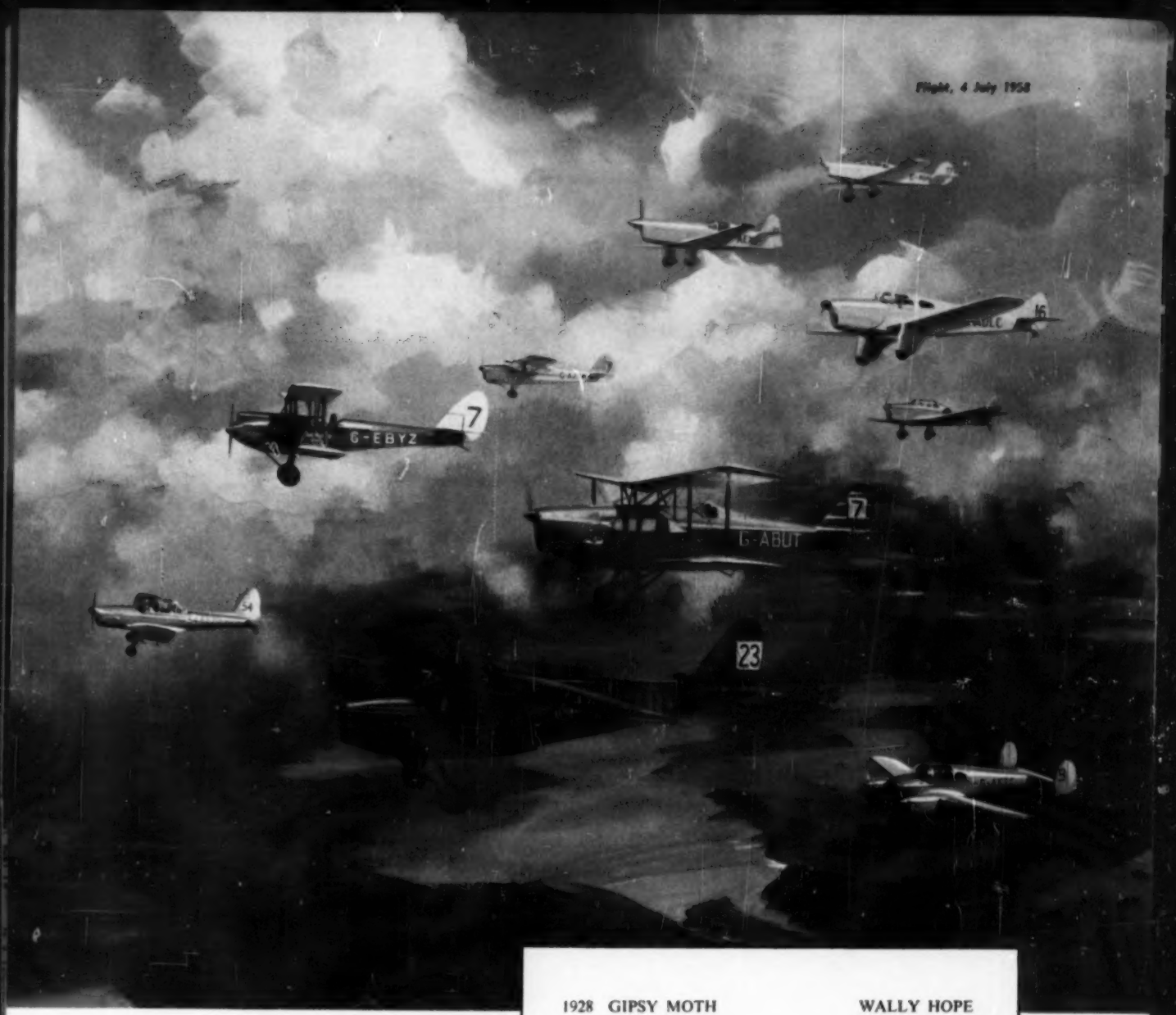
PICTORIAL NAVIGATION PRESENTATION

DETAILS have now been released concerning the Kelvin Hughes map roller equipment Type 2, which is designed to be driven by Doppler signals. A 30ft strip of map is passed through a back-lighted panel measuring 4½in × 5in on which a pen traces the aircraft track according to either Doppler signals or a groundspeed and heading manually inserted by the pilot. The equipment is intended to facilitate accurate course-keeping by a pilot of a high-speed, low-level strike aircraft and is therefore simple to operate and mounted as close to the line of vision as possible. A second instrument, mounted nearby, shows a 20-deg segment of a normal compass card against which a needle indicates deviation from a manually set compass heading.

A ground-speed dial may be manually adjusted or locked to Doppler signals by setting to a datum of 250 kt. If the map tracer reaches the edge of the panel after an excessive departure from designated course, a memory facility will continue to compute progress at distances up to twice the width of the map either side of course. A trigger head at the edge of the map strip contains two electrical contacts which can be connected by spots of conducting paint applied to the map strip. When contact is made a tape recorder is actuated to give the pilot in aural form information required at that point in the flight. It is intended that the outbound and return legs of a flight be attached end-to-end to form the complete strip.



Units of the Kelvin Hughes map roller equipment Type 2.



1928	GIPSY MOTH	WALLY HOPE
1932	FOX MOTH	WALLY HOPE
1933	LEOPARD MOTH	"de H"
1935	FALCON SIX	TOMMY ROSE
1936	VEGA GULL	CHARLES E. GARDENER
1937	MEW GULL	CHARLES E. GARDENER
1938	MEW GULL	ALEX HENSHAW
1949	GEMINI	NAT SOMERS
1950	HAWK TRAINER	EDDIE DAY
1953	CHIPMUNK	PAT FILLINGHAM
1955	MEW GULL	PETER CLIFFORD
1956	AUSTER ALPHA	JIMMY DENYER

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SIR W. G. ARMSTRONG WHITWORTH AIRCRAFT LTD., BAGINTON, COVENTRY

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Computers for Simulators: A.C. or D.C.?

EXPERIENCE WITH BOTH METHODS

By KENNETH H. SIMPKIN, A.M.I.E.E., A.M.(Brit.)I.R.E.*

ALTHOUGH designers of flight simulators keep an open mind on the relative merits of A.C. and D.C. computing, the use of one or other method has become the subject of strongly worded argument between two extreme schools of thought, the one admitting only the use of the established A.C. systems and the other equally adamant about the wholesale advantages to be gained from the more recent D.C. equipment. Some five years ago the writer made a study[1] of the important factors involved; and since that time, Air Trainers Link, Ltd., has used both forms of computing with equal facility, deciding each case on its individual technical and commercial merits. The experience gained might prove useful in a new attempt to assess the position in a more practical light.

Opinions expressed in print have invariably been one-sided, since extensive experience in both fields is rarely achieved by one group; and one suspects that a political approach has not been entirely absent. The technique of D.C. analogue computing has particularly suffered, since arguments levelled against it have been outdated by developments which have not, for commercial and other reasons, been widely publicized.

The factors involved are wider than is generally admitted because, with equipment of such complexity and capital cost, questions of economics, maintenance, staffing and company experience have to be considered equally with technical arguments. The computing requirements are here briefly examined together with the fields in which D.C. and A.C. computing may be used to the best advantage; and some general conclusions are drawn from experience in the design, manufacture and maintenance of flight simulators over the past few years.

Computing Requirements. A flight simulator may be broadly divided into five computer groups, namely, the flight computer, the engine and propeller computer, the ancillary services computer, the radio-aids and recorder system, and the control-loading simulation. The functions of these are self-evident; and the last-named will not be discussed since the only source of electronic computing lies more logically in the flight computer. Control-loading simulation is otherwise a problem of mechanics and hydraulics or pneumatics.

The flight computer continuously solves the equations of motion of the aeroplane. It analogues the forces and moments acting on the aircraft structure in terms of dynamic pressure, lift coefficient, incidence, yaw, control surface angle and Mach number, and integrates the resultant angular and linear accelerations to produce component velocities and displacements along and about the flight path or stability axes of the aircraft. Resolution of these into a reference set of earth axes provides the velocities and displacements of the aircraft in north-south, east-west and vertical directions; and a similar inverse resolution of the weight of the aircraft into the flight path axes produces the weight components acting in concert with the aerodynamic forces along those axes.

The essence of the flight computer lies, therefore, in the ability instantaneously to analogue complex functions of basic parameters with high transient accuracy, to analogue the integration of accelerations with negligible lag in real time, and to resolve vectors from one set of axes to others without loss of accuracy, resolution or smoothness, even under high rates of change of the vectors. A flight computer is normally assessed in much the same way as an aircraft, by measurements of the steady-state performance in level flight and climbs under given power settings, of control surface angle to trim, and of the transient performance as given by the longitudinal, short-period and phugoid oscillation and the lateral motion in roll and yaw.

An indication of the order of accuracy, range and resolving power desirable in a flight computer for a transport aircraft, a bomber and a fighter are given in Table I.

TABLE I

Parameter	Transport	Sonic Bomber	Supersonic Fighter
Phugoid period	35 sec	34-110 sec	55-250 sec
Phugoid damping	0.6	0.5	0.14-0.04
Pitch period	3 sec	2 sec	1.8 sec
Yaw period	6 sec	6 sec	1-4 sec
Spiral time to 1/2	40 sec	60 sec	200-1000 sec
Max. angular rates	0.8 rad/sec	1.0 rad/sec	5.0 rad/sec
Range of rates	1 : 1000	1 : 3000	1 : 20,000
Max. climb angle	±70 deg	±80 deg	±180 deg
Resolution of climb angle	1 : 2500	1 : 7000	1 : 20,000
Max. roll angle	±90 deg	±90 deg	±360 deg
Resolution of roll angle	1 : 1000	1 : 1000	1 : 3000
Max. climb rate range	1 : 600	1 : 1500	1 : 1500
Height range	0-30,000ft	0-60,000ft	0-80,000ft
Height resolution	1 : 6000	1 : 12,000	1 : 16,000
Speed range (Vt)	0-400 kt	0-600 kt	0-1200 kt
Speed resolution	1 : 800	1 : 1200	1 : 2400
Vertical acceleration	1½ g	4 g	8 g
Resolution of vert. acceleration	1 : 2500	1 : 4000	1 : 8000

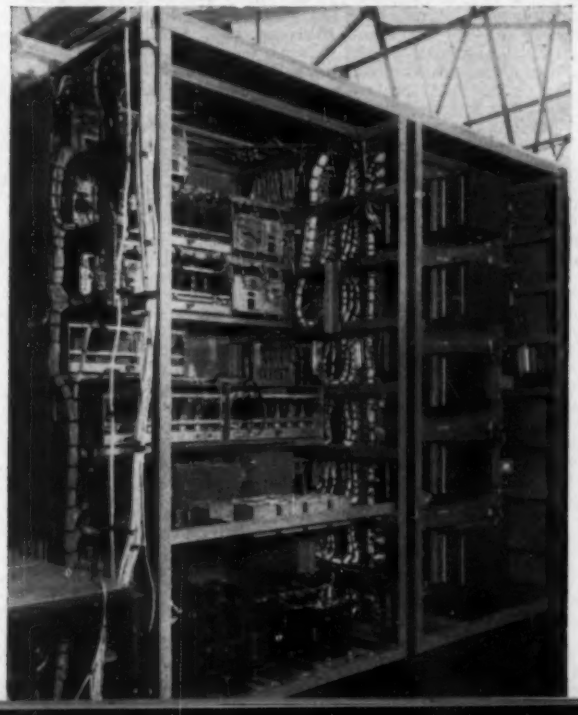
The engine and propeller computer is an analogue which balances engine and propeller torque to determine r.p.m. and hence fuel-flow and thrust. The complex relationships of torque, fuel-flow, thrust and engine temperatures as functions of velocity, height and Mach number are produced by potentiometer functions combined to represent these carpet relationships; the successful simulation of an engine relies largely on the accuracy and resolution of these parameters and their rates of change. In order to produce accuracies in thrust and r.p.m., for example, of 1 per cent, it is necessary to compute individual functions to within 0.2 per cent within the normal operating range and 1 per cent outside it.

Flexibility is important to the ancillary services computer because it must be able to simulate differing requirements with the smallest possible number of standard computer units. This arises because the method of simulation is rarely a true analogue and the services simulated vary considerably between aircraft types.

The function of the radio-aids and recording system may be divided into the computation and recording of ground-position on a map and the computation and presentation of a variety of radio and approach-bearing information to the pilot. The accuracy of ground-position is dependent on the resolution of aircraft velocity into north-south and east-west components and the subsequent integration of those components to drive the recorder pen and derive range and bearing information. Allowing a reserve for instrument errors and the performance of radar bearings, the accuracy of bearing should be 0.5 deg and the accuracy of integration 1 per cent. In order to follow small changes of track smoothly, the integrator should be able to follow a speed-range of at least 500 : 1, but the accuracy of angular radio bearings need not be better than 2 deg because the airborne equipment is rarely equal to this. In the case of approach aids such as I.L.S., the value representing angular departure from the datum approach path must be accurately resolved from cartesian co-ordinates and be of high resolving power, since an angular change of six minutes of arc in track is easily noticed by the pilot.

D.C. Computing. Table II shows the resolving power which can be expected from standard D.C. equipment used by Air Trainers

D.C. power unit and flight computer for the Vulcan 1 flight simulator.



*Project manager, Air Trainers Link, Ltd.

D

COMPUTERS FOR SIMULATORS: A.C. OR D.C.?

TABLE II

Unit	Standard	Drift-corrected
Strip-card and rotary potentiometer resolution	1 : 3000	—
Helipot resolution	1 : 10,000	—
D.C. amplifier summer resolution	1 : 18,000	1 : 360,000
D.C. amplifier open integrator drift	20 per cent/hr	1 per cent/hr
Sine-cosine potentiometer resolution	0.5 deg	—

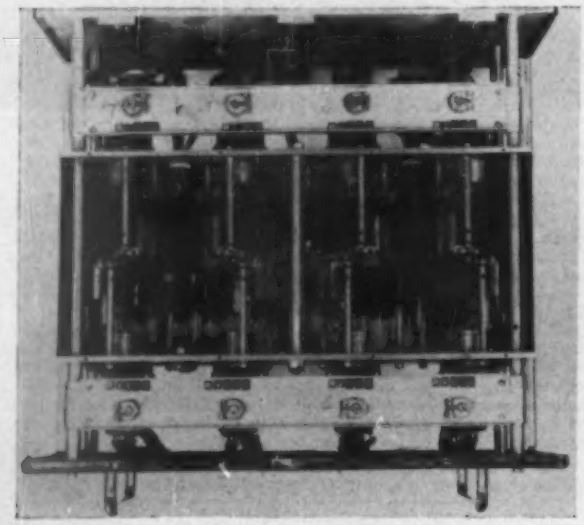
Link. As seen in Table I, the major computing problems involved in a flight computer are the instantaneous resolution of the longitudinal weight component and the derivation of complex functions of aerodynamic parameters which may be changing at high rates. The former problem has been eased by the adoption of a novel form of electronic integration of the climb angle [6,7] and the latter by the electronic integration of linear forms of the aerodynamic functions with subsidiary correction by potentiometer cards to achieve the desired overall non-linearities in quasi-steady state.[8]

The short period oscillation in pitch is simple to achieve and the lateral oscillations are problems similar to, but of lesser degree than the phugoid case. As a result of fully electronic integration, summing and function generation of the flight computer parameters—without recourse to complex electronic multiplication—the high resolving power of D.C. amplifiers allows smooth response and accurate damping at low oscillation levels to be achieved without non-analogue *ad hoc* damping terms. Furthermore, amplifier-drift correction is unnecessary because the feedback loops, which form a positional override on the integrators in the flight computers, are drift-corrected as loops. The ratio of standard to drift-corrected amplifiers is therefore about 10 : 1.

The use of D.C. computing outside the flight computer is justified by general advantages enumerated later. Technically, the resolving power of D.C. amplifiers is necessary for the summation of engine non-linear function terms. In addition, the wide range of integration rates available from D.C. integrating servos, together with the use of memory devices to retain long-term accuracy, helps in the integration of northing and easting velocities for the pen recorder and radio station co-ordinates.

Before examining the fields in which A.C. computing is of value, it would be as well to dispel some of the false impressions about D.C. amplification which have arisen. These criticisms are concerned with drift, power supplies and unreliability. By their very nature, D.C. amplifiers suffer from drift just as A.C. amplifiers suffer from noise and variable phase-shift. But drift can, in practice, be minimized by suitable choice of working potentials and valve type in the first stage, which does not imply valve selection, by ageing of valves and by avoiding frequent electrical and mechanical disturbance such as H.T. switching and removal of units. Without any other precautions, drift levels of less than 10 millivolts can be obtained over periods in excess of 120 hours. Drift correction is applied to the most sensitive parts of the computer in order to widen the operating range, but only when necessary.

A.C./D.C. resolver unit.



It is also true that D.C. amplifiers require a multiplicity of H.T. supply levels, but most of these are at low power and the problem is purely one of design. The finished supply unit is no more difficult to manufacture, set up or maintain than a single-line regulated unit. Self-monitoring of these supplies facilitates simple fault location; and insistence on the use of standard supply units of at most three capacities results in a range suitable for all flight simulators, analogue computers and laboratory requirements.

Reliability is associated with the effectiveness of maintenance; and it has been found that the use of D.C. computing simplifies the task of maintenance training and reduces the complexity of test equipment. The reliability to be expected of satisfactory designs is shown by returns taken at random in the field from simulators based on D.C. computing and manufactured by Air Trainers Link, Ltd. They show 95.5 per cent and 93.4 per cent serviceability in two prototypes and 95.6 per cent and 89.9 per cent serviceability in two production simulators while working for over 10 hours per day. In this case, 100 per cent would indicate that all facilities provided by the simulator were serviceable.

A.C. computing. The advantage does not lie entirely with D.C. because there are purposes for which A.C. signals are eminently suitable. Table III briefly lists the resolving capabilities of A.C. equipment, both at 50 c/s and 400 c/s. Lower resolutions are quoted for potentiometers because of the limiting resistance values with A.C. if excessive phase errors are to be avoided.

TABLE III

Unit	50 c/s	400 c/s
Rotary potentiometer resolution...	1 : 1500	1 : 1000
Helipot resolution	1 : 5000	1 : 2000
A.C. amplifier summer resolution	1 : 200	1 : 200
A.C. electro-mechanical integrator—open loop	—	1 : 200
Synchro resolution	2 deg	1 min
D.C.-A.C. modulator range	—	1 : 200

Summing amplifier resolution is limited by noise level unless special precautions are taken; and the speed range of the motor integrator is limited by noise and tachometer characteristics. It is nevertheless apparent that the accuracy of ten min and the resolving power of one min of arc obtainable from modern 400 c/s synchros is a valuable feature which cannot be matched in purely D.C. computing. It has been found that, provided the difficulties of drive amplifiers are overcome, the angular resolution of 400 c/s A.C. is particularly suitable for radio-aids and radar simulation, where smooth resolution of range and bearing is important.

As in D.C. systems, the success of A.C. computing greatly depends on adequate standard units and suitable power and signal supplies, for it is impossible to take advantage of the high angular resolution of A.C. synchros unless the quadrature component and noise levels of the signal supply throughout the system are low and frequency stability is good. The percentage "goodness" of A.C. and D.C. power and signal supplies must both be adequate; and the equipment required to achieve satisfactory performance is not substantially greater for D.C. supplies than for A.C.

A.C. at 400 c/s is also useful for driving instrumentation. In a simulator the instrument presentation is identical to that in the aircraft but a different source of movement is employed. Synchros working at 50 c/s and 400 c/s are widely used to drive simulator r.p.m. gauges, altimeters, A.D.F. indicators and the like; and the advent of 400 c/s aircraft instrumentation with self-contained magnetic amplifiers—flight systems, autopilots and instruments driven from a master reference gyro—has made 400 c/s instruments with A.C. drives most attractive, especially where the expense of designing an alternative is high.

Maintenance and fault location are difficult with A.C. systems. High-resolution systems, such as those used in flight simulators, present a problem because even small levels of pick-up, noise and phase errors can materially affect overall accuracy and measurements are difficult to make and require special test equipment. Suitable training of maintenance staff and provision of test facilities can help, but the standard of staff or the length of training must be greater than those for maintaining D.C. computers.

Air Trainers Link simulators do contain extensive 400 c/s and 50 c/s A.C. devices in the areas indicated above. A pure A.C. system is rare because, with suitable power supplies, the inherent advantages of D.C. integration make a combination of A.C. angle resolution and data transmission with D.C. phase-sensitive rectification and integration a valuable facility. In this way the full resolving power of the synchro is achieved overall in a follow-up system and the stages of D.C. amplification may be used to provide rate and acceleration terms as well as amplification of the signal. An Air Trainers Link warfare training equipment which is about twice as complicated as a flight simulator and is based on these A.C./D.C. techniques, has shown a serviceability proportional to that of the D.C. flight simulators mentioned above.

(Continued at foot of opposite page)

AIR GATEWAY TO MOSCOW

Air travellers from all over the world enter Moscow by way of Vnukovo airport. The vast Aeroflot fleet now includes numbers of Tu-104s, three of which are shown, above, on the Vnukovo apron with Il-14s beyond. At left, the new Il-18 Moskva waits in a hangar. Below, the control tower with full communications and lighting controls, surveillance and precision-approach radars.

COMPUTERS FOR SIMULATORS: A.C. OR D.C.?

(continued from opposite page)

Conclusions. The major technical-design problems of a flight simulator involve high degrees of linear resolution and high transient accuracies in self-balancing loops of the flight computer, extreme resolution in function-generation in the engine computer, and high angular resolution and range of integration rates in the radio-aids and recorder systems. It seems that while all-A.C. simulators are in use for transport aircraft, D.C. computing in flight and engine computers will become desirable if not necessary when providing for smoother operation and greater accuracy and the wide speed and height range and marginal stability of modern aircraft.

Where angular resolution is necessary in radio-aids and radar simulation A.C./D.C. techniques combining the resolving power of the 400 c/s synchro with the accuracy and resolution of D.C. have proved their worth.

The difficulties associated with drift, power supplies and serviceability in D.C. computers have been overcome by proper design, standardized units and normal precautions prior to and in service. Both D.C. and A.C./D.C. equipment has, in the writer's experience, been shown to give consistently good serviceability.

The technical choice of method must be influenced by many other factors, not the least of which is the experience and training of the customer's staff in the various techniques.

Finally, it is the writer's experience that the problems of designing, manufacturing and maintaining flight simulators and similar equipment can be reduced to routine, provided that there is a suitable range of standard units which, though complex in themselves, can be relied upon and treated as "black boxes" which can be left alone.

The conclusions, therefore, have not changed markedly in the past five years, the case for D.C. having strengthened in some respects, and that for A.C. having weakened in favour of combined A.C./D.C. techniques. These conclusions must, however, be affected by the availability of suitable components in this country, as compared with elsewhere.

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3—THE FINAL WEEK

BY KENNETH OWEN of "Flight" staff (a member of the British team)

World Gliding Championships

THREE consecutive non-flying days at the end of the first contest week had made pilots, crews and the miscellany of hangers-on at Leszno keen to see some flying again, which they were able to do on **Sunday, June 22.** As I briefly reported in ending the despatches published last week the task was a goal race to Ostrow Wielkopolski, 95 km to the east, with a strong and gusty wind blowing from the west-southwest.

Soon after Deane-Drummond in the Olympia 419 had taken off for the first launch at 11 a.m., Leszno Airfield appeared to be lying in the centre of a bowl of towering cumulus. Many pilots spent time cloud-flying near the airfield before crossing the starting line: as the *en route* conditions were extremely changeable, much depended on getting away at the right time.

The first arrivals at Ostrow, announced over the Leszno loudspeakers at about 12.45, were those of Jean Weiss and Daniel Barbera of France, each flying a Bréguet 901s, closely followed by Juhani Horma of Finland in his standard-class PIK-3c. As landing reports continued to come in, we were surprised to hear that two of the experts—Saradic (Jugoslavia) and Kumpost (Czechoslovakia)—had landed short.

The biggest surprise of the day, however, was that Horma in the modest PIK-3c had flown faster than any of the open-class pilots. His time for the race was 1 hr 3 min, giving an average speed of 87.5 km/hr. He had made two climbs only, the first to 3,900ft (after entering cloud at 2,600ft) and, after coming down to 2,000ft over Gostyn, the second in a cu-nim which took him up to 7,500ft.

Out of the total of 61 entries, 45 pilots succeeded in reaching the goal. For the British team it was a day of mixed fortune—

The gaily decorated dining-hall at Leszno. With one of the British team cars are teamsters Mrs. Kitty Wills and Ray Stafford Allen.

while the two Goodharts and Wills were successful, Deane-Drummond landed 10 km short and so forfeited his close second place to Haase on total points. The irony of this was that he had been well on the way at about 7,000ft when he had decided to return to Leszno for another start, in the hope of making a better time. [In London next day a garbled report which mentioned "ditching" caused a good deal of speculation and a certain amount of anxiety. *Flight* was able to reassure inquirers—Ed.]

Haase in the HKS.3 was once more the day's open-class winner with 86.8 km/hr and 1,000 points, followed by Komac, Makula, Weiss and Maxey. Nick Goodhart was level seventh with Barbera. Behind Horma in the standard class were Wojnar, Huth, Compton and Gonczarenko. The overall open-class leaders were Haase, 3,778 points; Mestan, 3,340; Laur, 3,320; Makula, 3,294 and Maxey, 3,245, with N. Goodhart seventh with 3,213 and Deane-Drummond ninth with 3,024. In the standard class Persson of Sweden was now in the lead with 3,384 points, followed by Witek, 3,299; Huth, 3,212; Tandefeld, 2,940; and Horma, 2,907. A. Goodhart was seventh with 2,544 and Wills seventeenth with 1,531.

The briefing on **Monday, June 23,** was postponed until 1 p.m., when it was announced that there would be no flying. As the afternoon brightened into blue skies and big, lively cumulus and cu-nims, it was the majority opinion among the competing pilots that someone had boobed. Another flying day missed. That evening, local midsummer festivities at the lake at nearby Osieczna, involving singing, dancing, bonfires on the lake and other distractions were dampened by a string of powerful thunderstorms.

Spirits, however, brightened next day, **Tuesday, June 24,** when the long-awaited free distance was declared as the day's task. While there was no contest regulation actually forbidding

(Upper) Edward Makula, Poland, in his Jaskolka Z.

(Below) Among Russian aircraft were SM-1 helicopters.

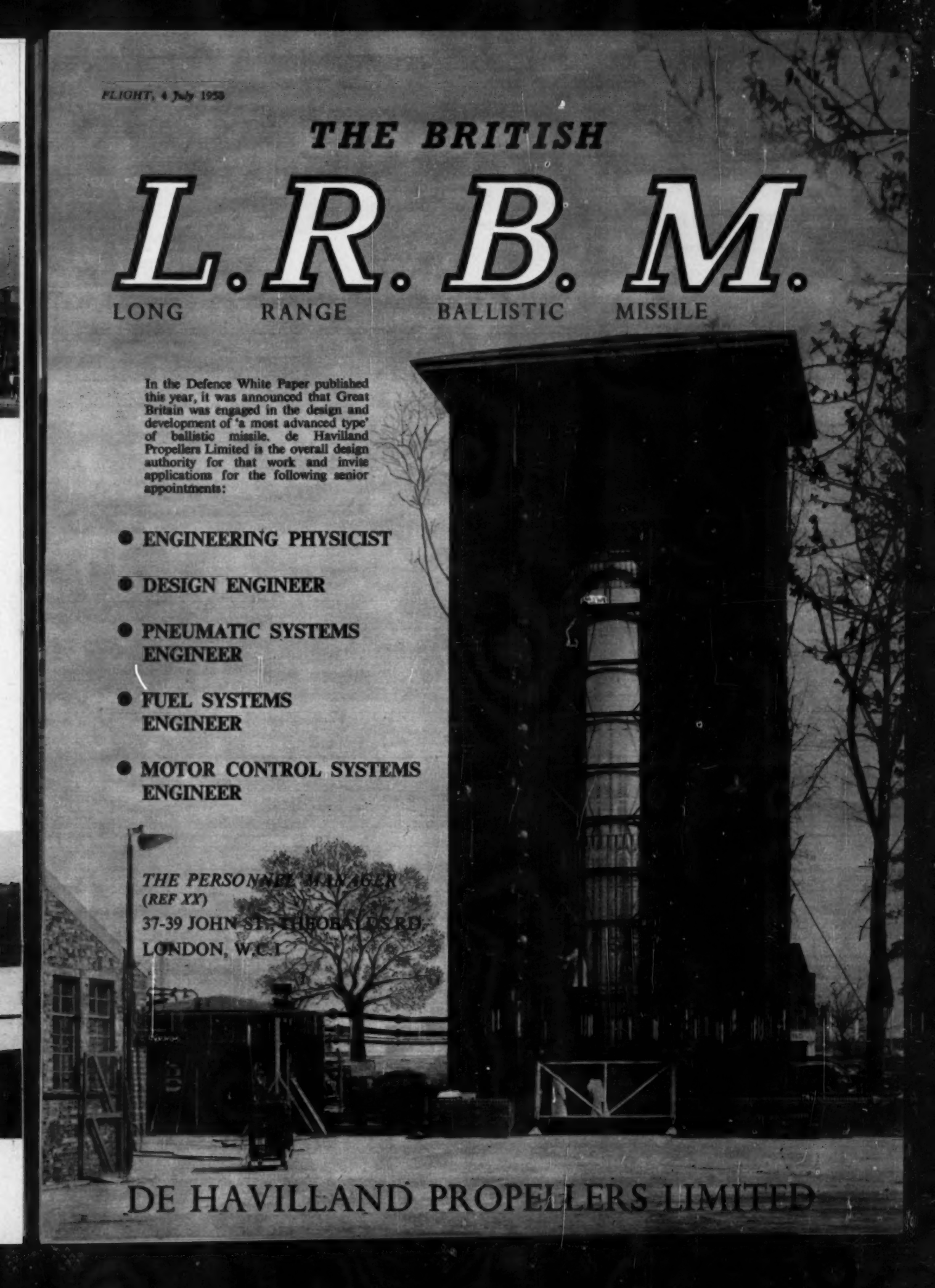
(Extreme right) N. Goodhart take-off seen over Michal Zweriow's (Soviet Russia) Jaskolka Z.

"Flight" photographs

THE BRITISH

L.R.B.M.

LONG RANGE BALLISTIC MISSILE



In the Defence White Paper published this year, it was announced that Great Britain was engaged in the design and development of 'a most advanced type' of ballistic missile. de Havilland Propellers Limited is the overall design authority for that work and invite applications for the following senior appointments:

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World Gliding Championships . . .

flights to other countries, the rules specified that the effective distance for marking purposes would go no farther than the border of the Polish People's Republic.

Although the met. situation was described at the morning briefing as "still very complicated," it was clear that it would be a good day for long-distance flights. Plenty of cumulus and cu-nim was forecast, with strong thermal strengths and a stiff wind from the west. Launches began at 11 and were complete by 11.30.

Pilots had carefully studied the exact location of the Polish-Russian border before take-off, and chosen one of two possibilities in order to extract the maximum distance in flights from Leszno. Northeast and southeast of Warsaw the border bulged out to give a few extra kilometres, compared with a flight directly to the east.

Lunchtime news was that most of the sailplanes were progressing well: the leaders had already achieved about 200 km and were approaching Lodz (pronounced Wooj). At a Press conference at Leszno, Mr. Jerzy Swiatek, director of the championships and vice-director of the Polish Aero Club, announced that foreign pilots were to be accepted for courses at the advanced soaring centre at Leszno, whose director is Mrs. Irena Kempowna-Zabiellowa.

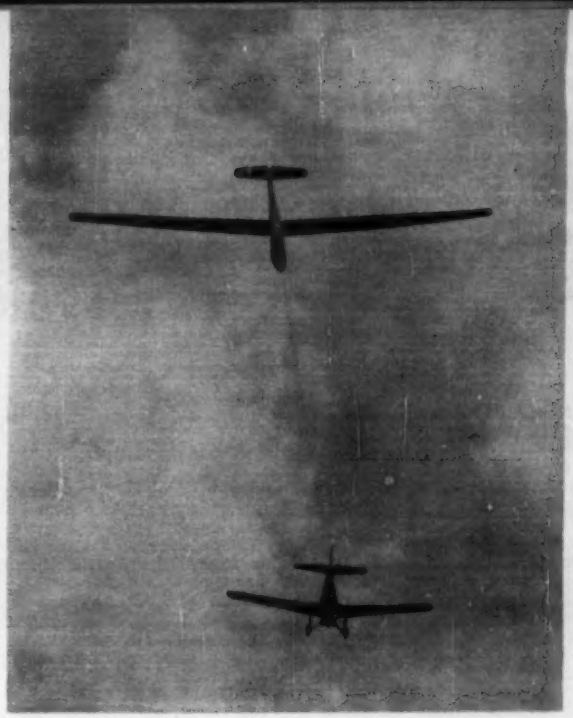
As the afternoon progressed and pilots from 22 countries headed steadily east, I was able to sample a small aerobatic piece of local aviation at Leszno with the help of a Bocian two-seater and Stanislaw Michalczyk, a young instructor from the gliding school at Zar. Ann Welch, captain of the British team, had flown a Bocian and also a Mucha-100 that morning, and had had the interesting experience of being outflown in one thermal by three of nature's bocians (storks).

The day's serious flying had, as expected, produced good results. As the landing reports came in and the numbered pins were stuck in the display map we were excited to see that several pilots had landed on or just short of the border. Makula, we heard, had arrived over the Soviet border with some 12,000ft in hand—but, after taking advice by radio, had landed on the Polish side. The map was sprinkled with a large number of pins around Warsaw, with two streams then heading northeast and southeast.

Ten pilots had flown more than 500 km, and 15 others had exceeded 450 km. In the southeast bulge were numbers 13 (Nick Goodhart), 10 and 11 (Komac and Saradic together in the two Jugoslav Meteors), and 34 (Kumpost, right on the frontier). Along the border to the north were three standard-class machines, Horma's PIK-3c, Witek's Mucha Standart and the Standard Futar flown by Opitz of Hungary. We realized that most pilots would need most of the next day to get back.

From Tuesday midnight to 4 p.m. on Wednesday it rained continuously at Leszno. Early on Wednesday evening the British crews arrived back at the airfield with a variety of stories to tell. Only factor common to them all was that each pilot had landed in a marsh, in each case stated to be of the original Pripet variety.

Nick Goodhart had made the best distance of the four, 514 km, and had seen Haase and Kuntz in the two HKS machines land nearby. Wills and Tony Goodhart had landed within a few kilometres of each other—and the former's fantastic retrieving story, involving dangerous journeys on a motorcycle pillion, has to be heard to be appreciated. Tony Deane-Drummond had flown 490 km to Chelm.



"Flight" photograph

Zugvogel 3, pilot Lyle Maxey (U.S.A.), on 20-metre tow behind Junak 2.

Stopping off for an hour in Warsaw on the return drive, several crews visited the look-out balcony of the all-dominating Palace of Culture (which rises to 750ft), where Charles Yeates of Canada averred this to be his greatest altitude for the last two contest days. The four British retrieving cars were driven a total of over 3,000 miles on this occasion.

Tuesday's leaders in the open class were Kumpost (536 km), Komac and Saradic (529 km) and N. Goodhart, Haase and Kuntz (514 km), with Deane-Drummond (490 km) lying tenth. In the standard class the first six were Horma (519 km), Opitz (518 km), Silesmo and Witek (517 km), A. Goodhart (480 km) and Wills (473 km).

On overall points, the totals were now:—

Open Class: (1) Haase, 4,737; (2) Mestan, 4,215; (3) Komac, 4,209; (4) Makula 4,205; (5) N. Goodhart, 4,172; (6) Maxey, 4,118; (7) Barbera, 4,088; (8) Laur, 4,059 (9) Deane-Drummond, 3,938; (10) Kuntz, 3,906.

Standard Class: (1) Witek, 4,295; (2) Persson, 4,259; (3) Huth, 4,021; (4) Horma, 3,907; (5) Tandefelt, 3,846; (6) Wojnar, 3,705; (7) A. Goodhart, 3,469 (8) Stepanovic, 3,243; (9) Rain, 3,091; (10) Labar, 3,057, with Wills in 17th position with 2,442.

By **Thursday, June 26**, most pilots were ready for more flying, with the exception of Weiss and Oates, whose aircraft had been damaged on landing, and Kuntz, whose HKS.1 had suffered badly in a road accident on the return journey. The task was distance along a line through Inowroclaw, roughly northeast from Leszno.

The day's two best flights were made by Nick Goodhart and Tony Deane-Drummond, who flew 209 and 206 km to Rogowo, near Torun. The weather was particularly interesting: soon after the sailplanes had been launched cirrus spread over Leszno from the west; the horizon was hazy and there was not much cumulus. Conditions would be light and, it seemed, might not suit the big boys.

The most significant feature of the day's flying, however, was that Goodhart and Deane-Drummond, who flew farthest, had taken off first. They had been leading the procession when, at about 4 p.m., the sea-breeze effect from the Baltic had moved down across their track and caused everyone to land. In these marginal conditions a light glider had a marked advantage, and several pilots jettisoned their bread rolls and the inevitable wurst in the interests of performance (as conditions went from bad to wurst, so to speak).

Not far behind the two British pilots was the group of regulars once more, including Kumpost and Marecek (202 km) and Haase (191 km). In the standard class, behind Huth (191 km), Tony

Above, open-class and standard-class champions Ernst Haase (left) and Adam Witek. Right, Witek's Mucha Standart crosses the finishing line after the Jelenia Gora out-and-return race on the first day of the contest.

"Flight" photograph

Left to right: British pilots Nicholas Goodhart (open-class runner-up), Anthony Deane-Drummond, Philip Wills and Anthony Goodhart; and Soviet pilot, Master of Sport and professional opera-singer Wiktor Gonczarenko.

World Gliding Championships . . .

Goodhart was second with 183 km and Wills was level third, at 179 km, with Horma and Witek.

This had been the strongest bid to date by British pilots to regain the high position (a very close second to Haase) held earlier in the championships by Deane-Drummond. It brought Goodhart up to second place in the open class behind the HKS.3 pilot.

A series of Camphill-type storms during Friday and Saturday brought the seventh world gliding championships to a sodden close, the only flying being exchange flights between pilots and gliders of different countries, and test flights by Lorne Welch, Paul Schweizer and Boris Cijan of the PIK-3c, Mucha Standart and Ka-6 in their OSTIV quest for a truly standard-class prize-worthy glider. The new world champions were Haase (the H in HKS) and Witek, with Nicholas Goodhart runner-up in the open class.

The championships were over. What had they shown?

With only a few exceptions they had *not* shown undue novelty in the sailplanes themselves. The open-class types had all been seen at previous championships, although improvements had of course been incorporated in many of them. There were no experimental or untried designs. As expected, the range of types included both the exotics and the Honest Johns.

The standard class was extremely interesting. The idea of 15-metre practical gliders clearly makes sense, and there was no lack of support from the various countries. It is noteworthy that the Standart version of the Polish Mucha not only set up the best performance in its class, but was among the three finalists for the OSTIV award for the machine nearest the true standard-class ideal. The French Bréguet 905 Fauvette was a delightful exception to the no-novelty rule.

Concerning the equipment fitted to the sailplanes, the most intriguing device was undoubtedly the thermal detector installed in the HKS.3 flown by Haase. Inspection of the aircraft disclosed two small metal plates, one near each wingtip, while inside the cockpit, low-mounted beneath and behind the instrument panel, was the pilot's indicator dial, basically a milliammeter. Other electrical equipment was installed beneath the pilot's seat.

Haase's detector was intriguing for two reasons. Firstly, there was doubt whether it had been used at all during the championships. Haase said that it had not, but a number of pilots who had watched his apparently unerring flying during the first contest week were not convinced.

Secondly, on what principle was the instrument based? According to Haase, the metal plates were simply covers in the absence of the resistance elements which would normally indicate the temperature gradient across the span and enable the pilot to turn towards the warmer air. Again a number of observers were not convinced: perhaps the plates themselves detected, say, the electrical charge gradient between a thermal and the surrounding air. The debate continued as I left Leszno for Warsaw (where the spike on top of the Palace of Culture was piercing the stratus layer) and the B.E.A. flight home.

All four British pilots were using Cook electric variometers, the prototype of which was fitted to Philip Wills' Skylark 3 for last year's national championships at Lasham. The prototype of the new Sperry H.L.9 artificial horizon for sailplanes was flown in the Olympia 419 piloted by Deane-Drummond at Leszno, while many international pilots were using the neat Cook compass.

Many pilots, perhaps, had expected too much of the Polish weather. Strong soaring conditions during the practice week and the first contest week were followed by more-difficult gliding weather alternating with violent downpours of Camphill 1954 vintage. Most of the flying had been over flat countryside, and there was nothing like the variety of conditions experienced at St. Yan two years ago—which during one day had given pilots thermal, wave and ridge soaring. Total score of contest days, six flown out of 13 (official permissible maximum, ten).

The flying results had underlined once more that a good pilot, even when flying, for instance, a Skylark 3, could outfly competitors equipped with more modern and elaborate sailplanes. They also emphasized that in world championships one slip can be fatal—the competition at the top is so keen that rarely can a bad day be compensated for later.

The new standard class has proved a great success in this its first international trial. With closely matched gliders the competition has been if anything closer than in the open class, and although Witek took the lead on the first day and triumphed in the final result, the intermediate days' flying was a fight all the way.

The Polish Aero Club organizers had obviously made a big effort to ensure the smooth running of the championships and to impress their foreign visitors. In general the organization worked well, except for the process of putting pilots and crews in touch with each other after cross-country flights. The difficulty here was caused partly by the inefficient national telephone service, and partly by the limitations of the operations-room organization. Another criticism voiced by members of the British team was that the official choice of daily tasks frequently differed from the team's idea of what the logical decision should be.

To ease the language problem at the briefing sessions, it was proposed by Sweden and agreed early in the contest that English should be the third official language (the other two being Polish and French) of the championships—an example of the organization's helpful flexibility in its approach to problems.

So much for the aircraft, the flying, the weather and the organization. But what of the Leszno atmosphere, and the incidentals by which we would remember championships?

There were the many uniforms around the airfield—not all of them worn by Boy Scouts. The bizarre variety of the tape-recorded music which poured incessantly from the loudspeakers. The storks lazily thermalling across the airfield. The Polish girl pilots with gold and diamond badges. The inter-tent parties, including the British one at which the chairman of the B.G.A. excelled in a rendition of *There are Fairies at the Bottom of my Garden*—and your correspondent's bed collapsed under the cyclic loads of an international octet.

For the pilots, there were the 20-metre tow-ropes—and the goldfish-bowl thermals, with the little fish circling inside and the big, fast sharks skimming round the outside. For everyone, the unpronounceable Polish language in which vowels seemed to have been abolished and replaced by Zs. All this, we remembered, was part of Leszno, 1958.

The starting line at Leszno Airfield, with Junak tugs on the left.

FINAL PLACINGS

Open Class: (1) E. Haase (HKS.3), West Germany, 5,651 points; (2) N. Goodhart (Skylark 3), Britain, 5,172; (3) R. Mestan (Demant), Czechoslovakia, 5,124 (4) B. Komac (Meteor 57), Jugoslavia, 5,118; (5) E. Makula (Jaskolka Z), Poland, 5,066; (6) D. Barbera (Bréguet 901s), France, 4,997; (7) A. Deane-Drummond (Olympia 419), Britain, 4,924; (8) J. Laur (Zugvogel 3), West Germany, 4,916; (9) L. Maxay (Zugvogel 3), U.S.A., 4,884; (10) J. Kumpost (Spartak), Czechoslovakia, 4,761; (11) A. Saradic (Meteor 57), Jugoslavia, 4,427; (12) V. Maracek (Demant), Czechoslovakia, 4,063; (13) A. Arcos (Skylark 3), Argentina, 4,031; (14) M. Gorzelak (Jaskolka Z), Poland, 4,016; (15) H. Molander (Zugvogel 3), Sweden, 3,937; (16) R. Kuntz (HKS.1), West Germany, 3,906; (17) R. Fonteilles (Bréguet 904), France, 3,885; (18) C. Yeates (Bréguet 901), Canada, 3,863; (19) L. Haza (Demant), Czechoslovakia, 3,857; (20) E. Burditt (Jaskolka), Rhodesia, 3,692. Total entries, 37.

Standard Class: (1) A. Witek (Mucha Standart), Poland, 5,232; (2) P. A. Persson (Zugvogel 4), Sweden, 5,086; (3) H. Huth (Ka.6), West Germany, 5,021; (4) J. Horma (PIK-3c), Finland, 4,844; (5) H. Tandefelt (Ka.6), Finland, 4,673; (6) J. Wojnar (Mucha Standart), Poland, 4,553; (7) A. Goodhart (Olympia 415), Britain, 4,427; (8) V. Stepanovic (Ilindenka), Jugoslavia, 4,170; (9) C. Labar (Bréguet 905), France, 3,973; (10) W. Toutenhoofd (Skylark 2), Netherlands, 3,702; (11) N. Opitz (Standard Futar), Hungary, 3,578; (12) Z. Rain (Ilindenka), Jugoslavia, 3,395; (13) P. Wills (Skylark 2), Britain, 3,379; (14) I. Silesmo (Zugvogel 4), Sweden, 3,352; (15) W. Gonczarenko (Mucha 100), Soviet Russia, 3,343. Total entries, 24.

Valiant

LAST OF THE VICKERS BOMBERS?

FIRST OF THE V-CLASS

THE Valiant is a Vickers bomber to rank with the Vimy and Wellington. What more could be said in its praise? It is a great aeroplane by any standards, and by their approach to its design, development and production Vickers-Armstrongs (Aircraft), Ltd., gave new pride—and a new measure of security—to this nation. The successful introduction of the Valiant into Royal Air Force service was an achievement of hardly less importance.

The Valiant production schedule was a tight one. An order for a prototype and production aircraft was placed in April 1948, and on August 27, 1957, the last off the line—which eventually extended to several score—was flown out of Brooklands. (From that same airfield the Vimy, Virginia, Wellesley, Wellington and the rest had all set out in their day.) The first production machine flew on December 21, 1953, and squadrons began forming during 1955.

The V-bomber programme, to which the Valiant was designed, represented a radical break with tradition, brought about by three main factors—the advent of the turbojet; the introduction of the nuclear bomb; and the development of electronic equipment capable of ensuring accurate bombing without sight of the ground. In their turn the greatly increased speeds and operating heights, and the need for accurate navigation and precision bombing, influenced every aspect of design. Though all these problems were, at the time the Valiant was being designed, almost entirely new (in an aircraft of such size at least) Vickers did succeed in solving them. They embodied the solutions in an airframe as handsome as any they had ever produced—and one that was very far removed indeed from the traditional four-engined bombers the design and production of which was still proceeding apace at the end of World War 2.

It was in the closing stages of the war that the Air Staff appreciated the coming change in the bomber environment. A highly imaginative and advanced specification was issued by the Ministry of Supply in 1946, calling for a bomber capable of carrying a nuclear weapon or a conventional bomb load, at altitudes around 50,000ft at high subsonic speeds, and for a very considerable range. No defensive armament was required, though electronic countermeasure techniques were to be exploited. Several companies submitted studies, and development contracts were placed with Avro and Handley Page for designs which became the Vulcan and Victor. Vickers had tendered unsuccessfully, but they continued to press their claim. Meanwhile, a contract was placed with Short Brothers and Harland for an "insurance" design—the Sperrin—of more conventional character. It was finally demonstrated that the Valiant met practically all the original V-bomber requirements, but was simpler and quicker to produce than either the Vulcan or Victor—an important consideration in those troubled times—and a specification was written round it. As mentioned above, the order was placed in April 1948.

Sir George Edwards, as chief designer at the time, was assisted by Mr. B. Stephenson (structures), Mr. H. H. Gardner (stressing) and Mr. E. J. Richards (aerodynamics). A project engineer who was closely associated with the design was Mr. E. E. Marshall; and Mr. E. Allwright, as assistant chief designer, has been responsible for much of the development.

The world situation in 1948 was unsettled, and Communist aggression was threatening. It was therefore demanded that the first Valiant should fly in 1951 and that a production machine should be airborne in 1953. George Edwards took up that challenge and the prototype did, indeed, fly on May 18, 1951. The pilot was the late Capt. J. ("Mutt") Summers and the co-pilot was G. R. ("Jock") Bryce (now chief test pilot). The Short Sperrin had not flown at that date.

The prototype Valiant B.1, WB 210 (at that time known simply as Vickers Type 660), was built under the supervision of Mr. A. W. E. Houghton (then experimental manager) and Mr. L. R. Webb at the small Vickers subsidiary establishment at Fox Warren, near Wisley. The first flight was made from the grass surface of Wisley, but testing was soon moved to Hurn, pending construction of the Wisley runway.

Highly polished all over, that first aircraft looked sleek and massive. Its gently swept wing contained the four Rolls-Royce Avons, breathing in pairs through a shallow "pillar-box" slot in each leading edge. The fuselage housed the crew in a compartment near the nose, and there was a cavernous bomb-bay amidships. The raked fin carried a variable-incidence tailplane at the mid-point, clear of the jet effluxes. Designed, according to tradition, by Vickers themselves, the undercarriage had main units consisting of massive tandem legs and wheels. The name Valiant was conferred shortly after the first flight.

The gruelling process of development now began in earnest. By early 1952 performance measurements were substantially complete, and WB 210 had been fitted with more powerful Avons (RA.7s of 7,500 lb static thrust). But in January, while noise-level tests in connection with the V.1000 were being carried out over southern England, an engine-bay fire developed and the crew were obliged to bale out. All five occupants managed to leave, but the co-pilot was killed when his ejection seat failed to clear the tail.

Fox Warren was already busy with the second prototype, WB 215 (Vickers Type 667), and this machine flew from Wisley on April 11, 1952. Its somewhat enlarged intakes were ready to accept the greater mass flow of the even more powerful Avons (RA.14s) which later replaced its RA.7s. Though the planned flight of the first production aircraft was approaching, Vickers were already far enough ahead to divert effort to the only Valiant B.2 (WJ 954)—a big, black beauty designed, it was clear, for high-speed operation at very low altitude. Its lengthened fuselage, and bogie main undercarriage, retracting into pods attached to the trailing edge, bespoke a much increased gross weight. The B.2 flew on September 4, 1953; and at the S.B.A.C. Show a few days later it performed some impressive low-level runs.

The first of five pre-production Valiant B.1s (WP 199) just made its delivery year, flying on December 21, 1953, powered by four Avon 200 series engines and bearing the works designation Type 764. Meanwhile the great task of production planning was

Among the thousands concerned with the design, construction and testing of the Valiant were these (their appointments are those pertaining at present): Sir George Edwards, C.B.E., B.Sc., F.R.Ae.S. (managing director); T. Gammon, O.B.E., M.I.Mech.E. (deputy managing director); A. W. E. Houghton (general manager); B. Stephenson, F.R.Ae.S. (chief engineer, civil); H. H. Gardner, B.Sc., F.R.Ae.S. (chief engineer, military); G. R. Bryce (chief test pilot); T. C. Parker, M.B.E. (general works manager); L. R. Webb, A.F.R.Ae.S. (general production manager); E. S. Allwright, A.F.R.Ae.S. (assistant chief designer); H. Zeffert, A.F.R.Ae.S., A.I.E.E. (chief electrical engineer); E. B. Trubshaw, M.V.O. (deputy chief test pilot); B. G. Aston, D.F.C. (chief production test pilot); D. Ganson (Valiant project engineer). Production Valiants were built at Vickers-Armstrongs' at Weybridge.

VALIANT . . .

undertaken by Mr. T. Gammon and Mr. T. Parker (then respectively works manager and works superintendent); and layout, jig and tool design were the task of Mr. L. R. Webb and Mr. J. E. Pull. Eight major sub-contractors were designated, amongst whom Saunders-Roe were responsible for the pressure-cabin section. A completely new building was set up at Brooklands to hold two parallel assembly lines; sculpture milling was used in the factory for the first time; and jig components were fabricated in pre-stressed concrete because of the shortage of steel. Glass plastics were extensively exploited for ducting and suppressed aerials.

Development of the Valiant continued. Several innovations had appeared on the second prototype in 1953, notably the fitting of under-wing pylons ("stalks," as they are known at Vickers) carrying auxiliary tanks holding well over 1,000 gal each. With these tanks the Valiant was to take part in the England-to-New Zealand air race in October but at the last minute participation was cancelled. Nevertheless, some indication of its capabilities was revealed by its intended route to Christchurch, with only two stops (at Karachi and Cocos Keeling), denoting a maximum stage-length of 5,000 miles. During 1954 a composite B(PR) variant was evolved for reconnaissance and survey photography. Eleven of these were interposed on the production line.

The work of accepting the Valiant into Bomber Command was already beginning. Airfields were being extended, with 3,000 yd runways and large hardstandings, and an entirely new training, maintenance and accommodation system was being prepared. Some of this was already in being when the Duke of Edinburgh visited Gaydon in July 1954 and saw a Valiant there. *Flight* noted then that squadron commanders and crews were already being selected.

If 1954 was a year of preparation and development, 1955 was the year of first realization. The Valiant entered squadron service, having passed its main qualification tests at A. and A.E.E., Boscombe Down, and a new O.C.U. (No. 232 at Gaydon, in No. 3 Group, Bomber Command) was established. The Valiant design was substantially frozen and production really began to get under way, building up to a peak delivery rate of one a week during the following year.

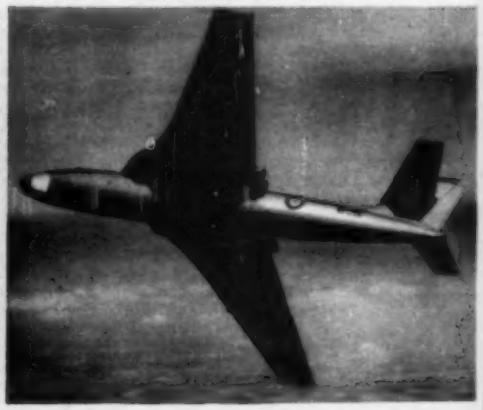
All but the first three Valiants were flown from the 1,300 yd strip at Brooklands. Lightly loaded, the aircraft would leave the ground after only 500 or 600 yd; and four machines were even flown back into Brooklands. Most of the take-offs were made by Jock Bryce, Brian Trubshaw and Bill Aston, who had by now joined Vickers. Several Service officers, including W/C. R. G. W. Oakley, who later commanded the first Valiant squadron (No. 138), were detached to Vickers during this period.

The year 1955 also saw the first sorties abroad. On July 31, a Valiant flew out to the Long-Range Weapons Establishment at Woomera for several months of bomb-ballistic trials; and it set up two new point-to-point records on the way—between Farnborough and Baghdad (523.5 m.p.h.) and between Singapore and Darwin (518.4 m.p.h.). Another Valiant carried out tropical trials at Idris; and two more, from No. 138 Sqn., flew out to Singapore. They continued together afterwards on a goodwill tour of Australia and New Zealand.

By March 1956 No. 3 Group had progressed far enough with the introduction of the Valiant to put the O.C.U. at Gaydon on show to the Press. In our report of the occasion, on April 6 of that year, we noted that "the coming of the Valiant marks the introduction of far more than just another airframe into service with the R.A.F." We compared the embryonic V-force with the U.S.A.F. Strategic Air Command and observed that "the importance of the V-bomber, both as the carrier of frighteningly massive retaliation and as a national capital investment, cannot be overestimated."

The tremendous cost and potential of each individual aircraft and crew was the main reason for the institution of a rigorous selection system. Valiant captains were required to have an "above average" rating and 1,750 hr as first pilot. They had to possess the highest flying qualifications, be "highly recommended" by their parent unit and have at least one tour on Canberras. Regardless of promotion, they would stay with a V-bomber squadron for five years. Co-pilots needed similar qualifications; and navigator/plotters, navigator/bomb-aimers and air electronics officers all had equivalent experience and underwent advanced specialist courses. At Gaydon, pilots spent some months studying the Valiant, worked in a simulator for 22 hr, spent more hours in Canberra T.4s practising I.L.S. procedures, and then graduated to the Valiant itself. Finally, the crews were made up and flights departed to their designated squadron bases.

By April 1956 three squadrons, Nos. 138, 214 and 543, had been formed, and a fourth was on the way. In the meantime the first official announcement was made of the Valiant B(PR).1, the dual-purpose reconnaissance and bomber version. In June, after a year of development work, it was announced that Valiants would be able to use two de Havilland Super Sprite packs to assist take-off.



In August 1956, a Valiant again went visiting abroad, when a machine of No. 207 Sqn., piloted by the C.O., W/C. L. H. Trent, V.C., and A.V-M. S. O. Bufton, S.A.S.O. of Bomber Command, flew out to the U.S.A. to observe the Strategic Air Command bombing competition. The Valiant returned non-stop from Loring A.F.B., Maine, to Marham, Norfolk, covering the 2,600 miles in 6 hr 10 min with a 120 kt cross-wind. One Valiant from No. 214 Sqn. and one from No. 543 Sqn. participated in the NATO Exercise Thunderhead, operating from Idris. Late in the summer two Valiants of No. 49 Sqn. took part in Operation Buffalo in Australia; and one of them dropped a British nuclear weapon at Maralinga.

Yet further development was achieved. Flight Refuelling, Ltd., designed a probe and a hose-reel pack for the Valiant, and provision for these was built into the new marks, BK.1 and B(PR)K.1. Several of these latter were interposed on the production line; but very many Valiants now carry the probe installation in the nose and the familiar fairing round the port side of the canopy which takes the fuel lines past the pressure cabin.

Extreme mobility is a vital factor in present-day strategic bomber operation. An enemy would strike quickly, hoping to achieve surprise, and his first target would almost certainly be the aircraft (or missiles) of the deterrent force. It is therefore vital that the deterrent should be capable of leaving its home bases and either dispersing, or setting off on its ultimate mission. The V-bombers should be able to act as "firemen" in a "brush-fire" war, and therefore to move far overseas and operate immediately (probably as conventional bombers). This the Valiants (and Canberras) were called upon to do in October 1956, when they moved within a matter of hours to Malta. From that base they achieved the doubtful distinction of becoming the first large jet bombers in the world to drop bombs in anger. Valiants of No. 138 Sqn. struck at targets in Egypt with H.E. loads.

In July last year C. M. Lambert of *Flight*'s staff participated in a two-hour training flight in a Valiant of No. 7 Sqn. (W/C. A. H. C. Boxer) from Honington. The machine was flown by the Station Commander, G/C. J. E. Grindon, and a crew made up of the station specialist officers all of whom keep in full training as a crew. Our report noted that "the operating procedure is planned in the minutest detail and nothing is left to chance. Each flight, therefore, is virtually made on the ground before take-off, the airborne part of it being something of an exercise to check the accuracy of pre-flight planning." Specialist briefings for the various members of the crew were followed by a joint briefing. The co-pilot calculated the fuel plan, fuel distribution and fuel sequencing routine. He watched the c.g. position at all times and also operated pressurization and powered control systems. The take-off was calculated in detail and the speed which the aircraft should have reached by the time it passed a white fiducial mark on the runway was known, so that take-off performance could be accurately assessed to facilitate a timely "accelerate-stop" if necessary.

Each Valiant ground-crew is commanded by a highly trained Crew Chief, a new key man in the R.A.F., and one who watches over the aircraft from the production line onwards. He has his own "jump-seat" in the cabin.

On our representative's flight the Valiant took off at about 120,000 lb, with the bomb-bay empty and less than full fuel load. Acceleration check-point speed was 110 kt, and unstick came at 112 kt—a long, long way before the end of the 3,000 yd runway. The climb to initial cruising height was begun at 275 kt and 4,000ft/min reducing to 240 kt I.A.S. at 30,000ft and 230 at 40,000. At 43,000ft the Valiant was settled into a gentle cruise climb at 0.75 Mach. With a cabin pressure-differential of 9 lb/sq in for normal flying, oxygen masks were worn but used only for intercom. In a leisurely outbound leg to somewhere beyond Glasgow, the Valiant drifted effortlessly up to 47,000ft at a final I.A.S. of 190 kt.

The whole operation was extremely smooth and comfortable in that quiet and fairly roomy green-lined cabin. Navigation was automatic and, during the final approach on returning to Honington, the aircraft's own equipment guided the pilot down the runway centre-line, though I.L.S. and A.C.R.7 radar held a watching brief. Three circuits-and-bumps followed the cross-country flight—the first a normal approach; the second and third respectively on three and two engines. There appeared to be no difficulty in achieving an absolutely normal landing on limited power, and the overshoot gave ample evidence of the tremendous urge of the Avon 200 series engines.

During October last year the Valiant force first competed directly with its main friendly rival—the U.S.A.F.'s Strategic Air Command. At Pinecastle two Valiants joined two Vulcans in the annual S.A.C. bombing and navigation competition. Though they were competing against American crews who had anything up to twelve years' continuous experience in S.A.C., Valiant XD 861, captained by S/L. R. N. Payne, came eleventh out of 90 in the combined bombing and navigation category for individual crews. In bombing alone, the two Valiants were placed 23rd and 45th; and in navigation 30th. The second Valiant, XD 859, was captained by F/L. R. Mather. For a force which was still young by strategic bombing standards, the Valiants did well. The mighty B-52s, themselves recently accepted into service, were beaten by the older B-47s and B-36s.

In the meantime, No. 49 Sqn. had moved to Christmas Island

(Continued on p. 18 after double page drawing of Valiant)

Stages in Valiant development: Left to right, first prototype B.1; second prototype B.1 (with enlarged intakes); early-production B.1; production B(PR).1; late-production B.K.1, seen carrying auxiliary under-wing tanks, the one-and-only B.2, which chronologically would come third.

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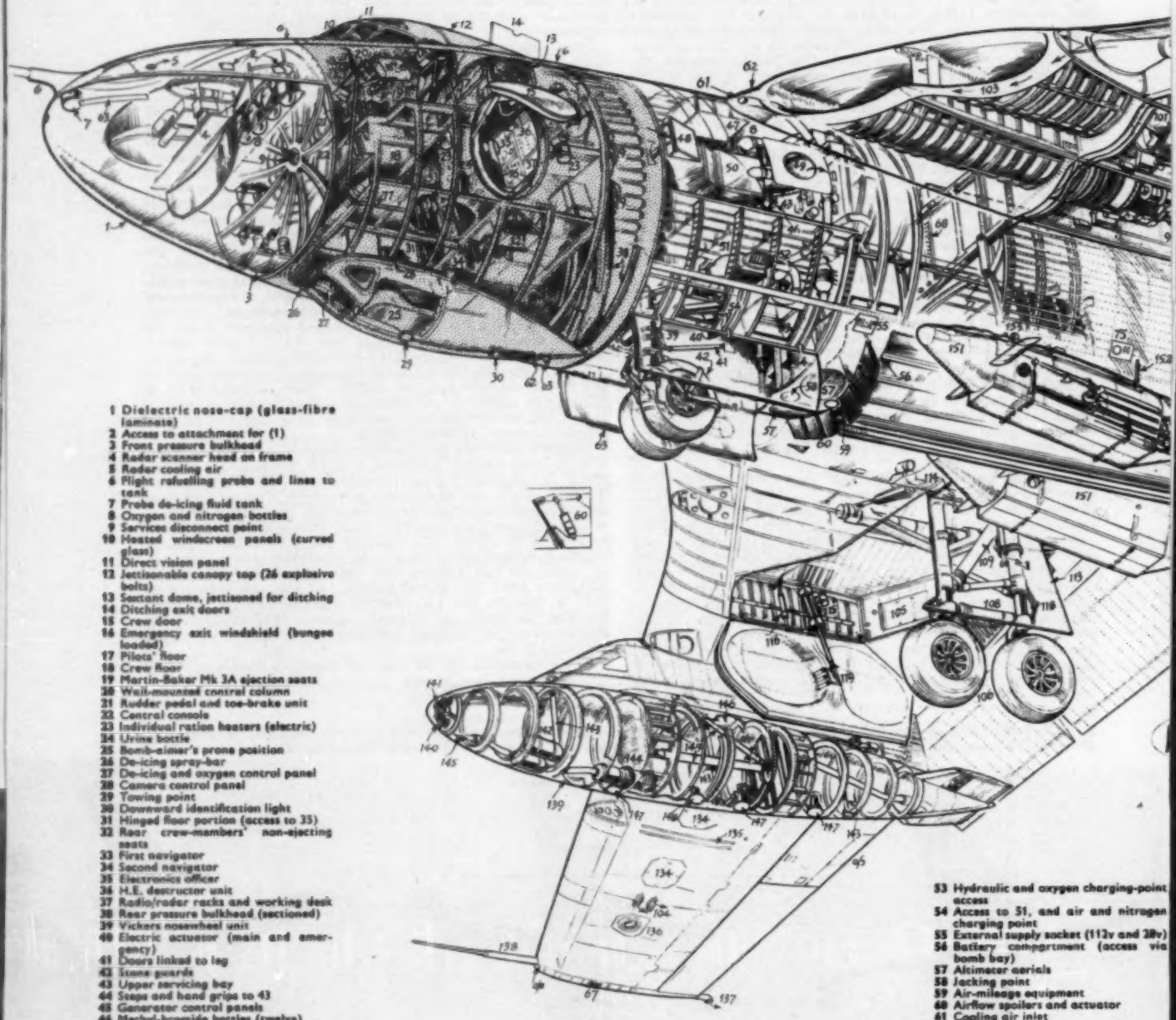
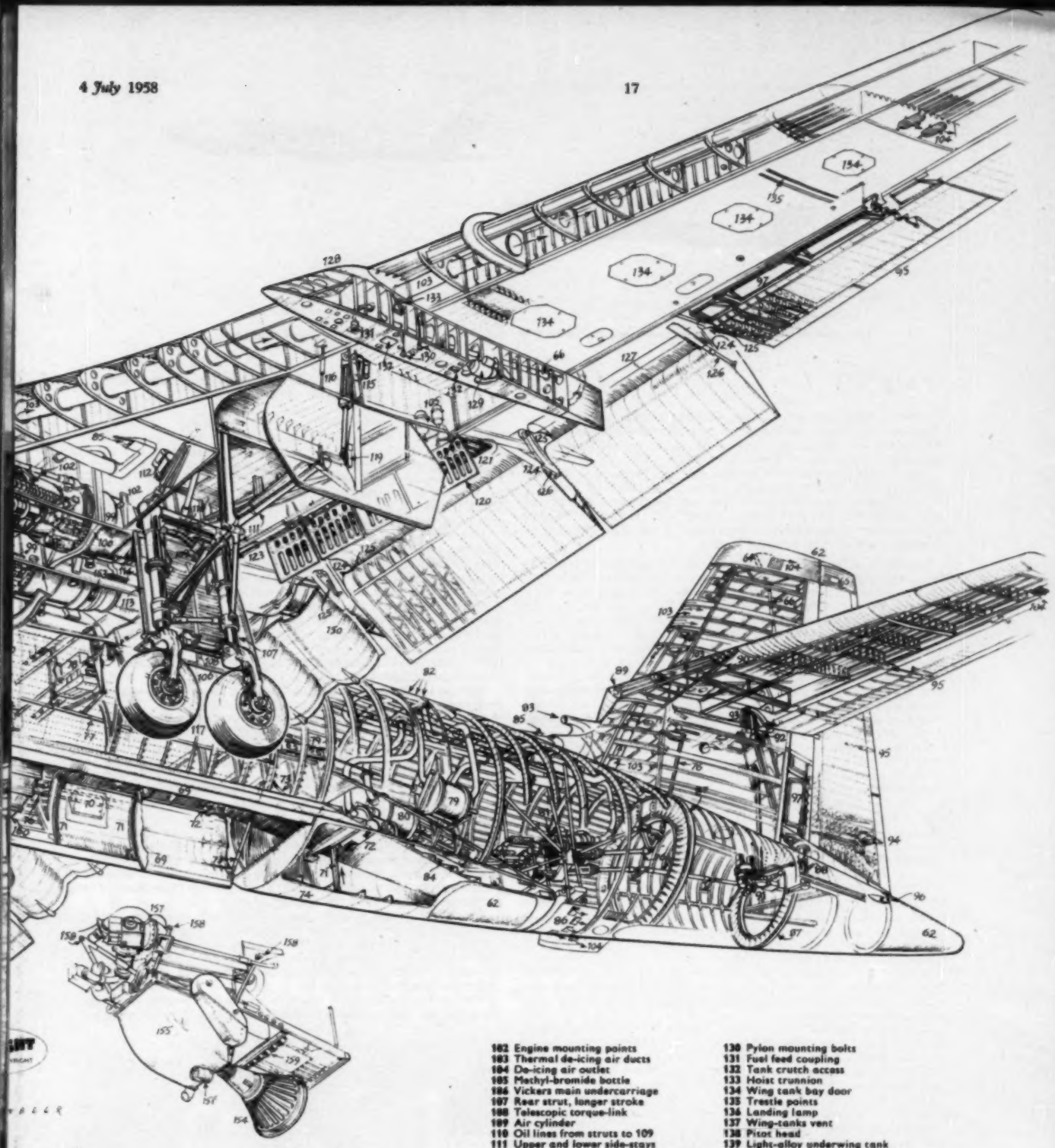
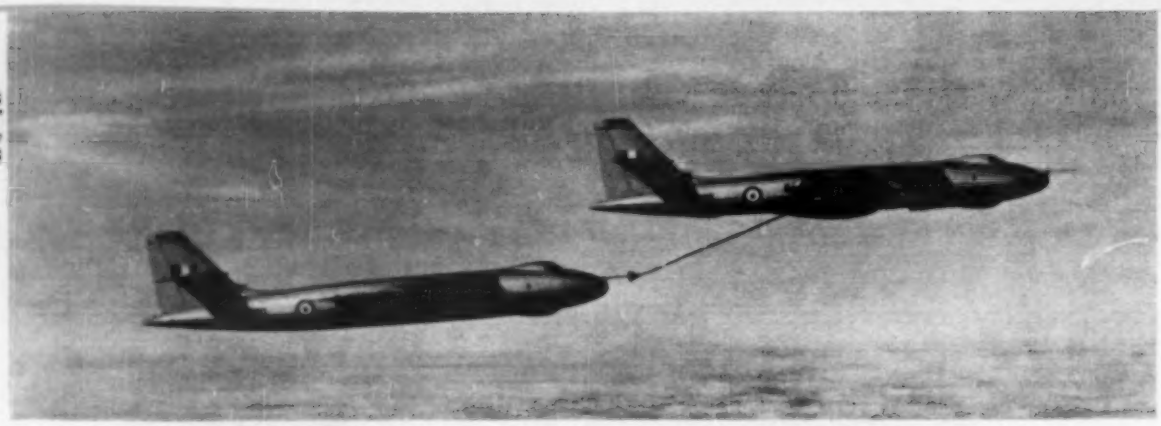
This drawing depicts all the principal features of a late-model Valiant BK.1. The artist has indicated a Super Sprite rocket pack installed beneath the starboard wing; another is shown as it might appear after jettisoning from the port wing. Below the rear fuselage can be seen the Flight Refuelling hose reel and drogue pack which converts the aircraft for use in the tanker rôle. The tinted area forward identifies the pressurized part of the fuselage.



1 Dielectric nose-cap (glass-fibre laminate)
2 Access to attachment for (1)
3 Front pressure bulkhead
4 Radar scanner head on frame
5 Radar cooling air
6 Flight refuelling probe and lines to tank
7 Probe de-icing fluid tank
8 Oxygen and nitrogen bottles
9 Services disconnect point
10 Heated windscreen panels (curved glass)
11 Direct vision panel
12 Jettisonable canopy top (26 explosive bolts)
13 Sextant dome, jettisoned for ditching
14 Ditching exit doors
15 Crew door
16 Emergency exit windshield (bungee loaded)
17 Pilots' floor
18 Crew floor
19 Martin-Baker Mk 3A ejection seats
20 Wall-mounted control column
21 Rudder pedal and toe-brake unit
22 Central console
23 Individual ration heaters (electric)
24 Urine bottle
25 Bomb-aimer's prone position
26 De-icing spray-bar
27 De-icing and oxygen control panel
28 Camera control panel
29 Towing point
30 Downward identification light
31 Hinged floor portion (access to 35)
32 Rear crew-members' non-ejecting seats
33 First navigator
34 Second navigator
35 Electronics officer
36 H.E. destructor unit
37 Radio/radar racks and working desk
38 Rear pressure bulkhead (sectioned)
39 Vickers nosewheel unit
40 Electric actuator (main and emergency)
41 Doors linked to leg
42 Stone guards
43 Upper servicing bay
44 Steps and hand grips to 43
45 Generator control panels
46 Methyl-bromide bottles (twelve)
47 Dinghy compartment
48 Flood-flow intake (emergency pressurization)
49 Flood-flow outlet (cover jettisoned)
50 Flood-flow intercooler
51 Air-conditioning compartment
52 Compartment vent
53 Hydraulic and oxygen charging-point access
54 Access to 51, and air and nitrogen charging point
55 External supply socket (112v and 28v)
56 Battery compartment (access via bomb bay)
57 Altimeter aerials
58 Jacking point
59 Air-mileage equipment
60 Airflow spoilers and actuator
61 Cooling air inlet
62 Dielectric areas
63 Aerials
64 V.H.F. aerial
65 Gee aerial
66 Cable duct
67 I.L.S. aerial
68 Front spar/centre-beam joint



69 Bomb-bay doors
70 Doors removed to show side-bay access panels
71 Rack
72 Pinion-shaft motor
73 Telescopic radius-rods
74 Bomb-bay deflector, hinged at rear
75 Pressure-refuelling point
76 Elevator and rudder control rods
77 Aileron control
78 Aileron power unit
79 Aileron feel-unit and cylinder
80 Elevator and rudder feel-units and cylinders
81 Elevator and rudder power unit
82 Three static vents for 79 and 80
83 Ram-air to feel-cylinders
84 Catwalk above deflector bay
85 Intake to de-icing system
86 Rear access hatch with free-flowing cabin-air exhausts
87 Sloping heavy frames for fin spars
88 Rudder torque-tube
89 Fixed portion of tailplane
90 V.I. tailplane hinged on 89
91 Tailplane motors and gearbox
92 Tailplane screwjack
93 Elevator mass balance
94 Trim tab
95 Balance tab
96 Navigation lights
97 Combined mass and seal balance on all surfaces
98 Rolls-Royce Avon 200-series turbojets
99 Firewalls
100 Detachable firewall integral with access doors
101 Starter in nose-cone
102 Engine mounting points
103 Thermal de-icing air ducts
104 De-icing air outlet
105 Methyl-bromide bottle
106 Vickers main undercarriage
107 Rear strut, longer stroke
108 Telescopic torque-link
109 Air cylinder
110 Oil lines from struts to 109
111 Upper and lower side-stays
112 Electric actuator (main and emergency motors)
113 Leg-well door linked to leg
114 Door top-flap
115 Wheel-well door electric actuator
116 Spring unit; operates up-lock jaws
117 Dunlop 50in tyres, wheels and multi-disc brakes with Maxaret units
118 Rigid brake pipes and hinge blocks
119 Six explosive bolts, emergency wheel-door release
120 Air brake on under-surface only
121 Plug plates
122 Air-brake gearbox
123 Air-brake operating screwjack and rods
124 Flap screwjacks (five each side)
125 Guide rails
126 Radius rods
127 Double-slotted flaps
128 Underwing tank pylon
129 In-line refuelling valve
130 Pylon mounting bolts
131 Fuel feed coupling
132 Tank crutch access
133 Hoist trunnion
134 Wing tank bay door
135 Trestle points
136 Landing lamp
137 Wing-tanks vent
138 Pitot head
139 Light-alloy underwing tank
140 Nitrogen and air charging points
141 Air bottle
142 Nitrogen bottles
143 Pacitor tank units
144 Fuel pump
145 Cooling air to fuel-pump motor
146 Manhole
147 Fuel jettison valves
148 Fuel drain valve
149 Tank support structure
150 Centre-section flaps under jetpipes
151 D.H. Super-Sprite A.T.O. pack
152 Rear mounting-points for 151
153 Front mounting points
154 Flight Refuelling hose/drogue unit
155 Hose reel shroud
156 Fluid-drive oil cooler
157 Pump group
158 Mounting points
159 Positioning signal-lamps
160 Aerodynamic fairing to accompany 154



"The most notable Valiant innovation, since the aircraft entered R.A.F. service, is the adoption of flight refuelling . . ."

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in order to take part in a further series of nuclear weapon tests. These involved flying the Valiant to its performance limits, especially in the maximum-rate turn used as an escape manœuvre immediately after nuclear-bomb release.

The Valiant is now fully operational with eight squadrons in No. 3 Group, Bomber Command. Nos. 7, 49, 90, 138, 148, 207 and 214 Sqns. are active in the bomber rôle from a number of bases, while No. 543 flies B(PR).1s and B(PR)K.1s from Wyton as part of the reconnaissance force. In addition, No. 199 Sqn. is engaged in special duties with Valiants.

Structure. The Valiant's light-alloy, stressed-skin fuselage is principally of circular cross-section throughout its 108ft 3in length, and consists of a nose cone; a pressurized cabin portion housing the crew of five (first pilot, second pilot, first navigator, second navigator and wireless operator); the main body; and a rear section. The lower portion of the nose cone consists of the radome, which is in the form of a shell of Hycar (glass-cloth and Neoprene) bonded with Nuron resin to form a double sandwich.

The pressure cabin is bounded by a concave bulkhead (front) and a convex bulkhead (rear). Reinforcing the stressed-skin covering are closely spaced longitudinal stringers of lipped Z-section and bulb angle; these are supported on lipped channel-section open frames. On the port side is an elliptical door giving entry to the cabin, and this same door, in conjunction with a hinged windshield, forms the emergency exit. There is one elliptical window in each side of the cabin, the starboard window being set into an escape hatch.

The cabin floor is built up from lateral channel-section members braced by longitudinal members, and the whole is covered with plywood. In the forward centre portion is a hinged door giving access to the bomb-aimer's position, in a fairing beneath the fuselage proper. Also at the forward end is the pilots' floor, which is raised above the main level.

The windscreen is composed of several panels, and the panel in front of each pilot has a wiper and de-icing facility. Immediately outboard of each pilot is a panel incorporating a direct-vision window. The entire jettisonable canopy, of characteristic Vickers form, is secured to the top frame of the hooding structure by 26 explosive bolts, and beneath the rear fairing structure there is a hemispherical sextant dome which can be pulled in to form an emergency exit. Pressure seals are used for the sextant dome and escape hatch, but the canopy itself and the main door also have inflatable pneumatic seals.

The main fuselage—that is, the portion between the pressure cabin and the rear fuselage—has a specially strong "backbone" member from which the bomb-load is suspended. It contains a bay for the nosewheel, a servicing bay, the bomb bay and a rear bay, and incorporates a moving portion (immediately aft of the bomb bay proper) which deflects air from the open bay. Like the other principal fuselage portions, this main part is of light-alloy stressed-skin construction, with externally flush riveting. The skin is reinforced by closely spaced longitudinal stringers of lipped Z-section and is supported on lipped channel-section open frames. The stringers only are attached to the skin; the frames are inside the stringers and are cleated to them. Heavy built-up frames are located in the area of the wing spars and tail attachment.

When the bomb doors are being opened they travel up the side walls of the bomb bay on toothed rack mechanisms. Thus, drag is not increased by opening them out into the airstream. Each door is raised and lowered by three motorized bogies, and the doors open and close in conjunction with the operation of the moving deflector surface, just aft of the bomb bay proper.

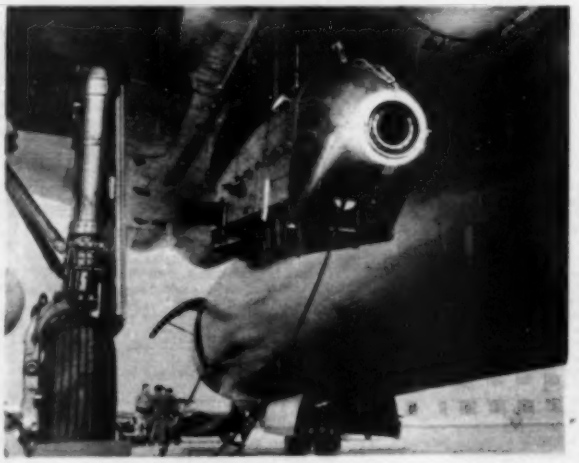
The wing has compound sweepback and is of deep root-chord. The inner sections of the wing carry the four Rolls-Royce Avon turbojets in a "buried" installation. Front and rear spars are of girder type, with channel-section booms, and are built in halves, integral with the fuselage. Each spar is joined at the centreline of the fuselage by a fork joint and taper bolts. The stressed-skin covering is reinforced with lipped Z-section chordwise ribs and channel-section spanwise stiffeners and intercostals. Between the spars are the four engine cells, and an intermediate bulkhead divides each of these cells into two areas, designated "compressor" and "combustion" zones. Each pair of engine cells is separated by a central longitudinal member, which also serves as a mounting for the engine control-lever assembly. The split flaps which are fitted on the inner sections of the wings also form part of the jetpipe outlet fairings.

The spars of the outer wings have channel-section booms tapering towards the wing-tips. Fork-joints and taper-bolts are used for the joint with the inner sections. The skinning is stiffened by Z-section spanwise stringers and by built-up ribs, and over the wheel bays there is a reinforcing inner skin. Thermal de-icing ducts run along the inside of the leading edge. Ailerons are of sealed, internally balanced type, and air brakes, in four sections, are hinged to the lower boom of the rear spar, ahead of the double-slotted, area-increasing trailing-edge flaps. The fuel tanks in the outer wings are of bag type. Detachable pylons permit the carrying of additional under-wing tanks or heavy stores.

The fin has a dorsal extension and is in three parts—the lower and upper portions and the moulded dielectric tip. The main members are two spars of angle-boom and plate-web construction, which carry the ribs. Thermal de-icing ducts for the tailplane pass from the lower part of the fin into the tailplane. Between the spars at the junction of the upper and lower portions of the fin there is a large reinforced opening, necessitated by the variable incidence of the greater part of the tailplane (all except the foremost, triangular, portion). The tailplane is swept back and the variable-incidence part, which is operated by an irreversible screw-jack, is constructed as a single unit. The leading-edge and trailing-edge members are connected by ribs of diaphragm type, and radiating from the centre to the tip, at top and bottom, are spanwise channel-section members, to which the skin is attached. Hot air from the de-icing system is exhausted from louvres on the under surfaces near the trailing edge.

Each elevator has a heavy-gauge torsion box extending the full length and incorporating four hinge-points. The diaphragm ribs are attached to the spar and the covering is of heavy-gauge skin. A D-section box formed by the spar and the leading-edge skin carries the operating torque shaft at the root end, and the hinge points for attachment to the fin.

The undercarriage (28ft track) is of Vickers design and Rotol manufacture, and is especially notable in having outwardly retract-



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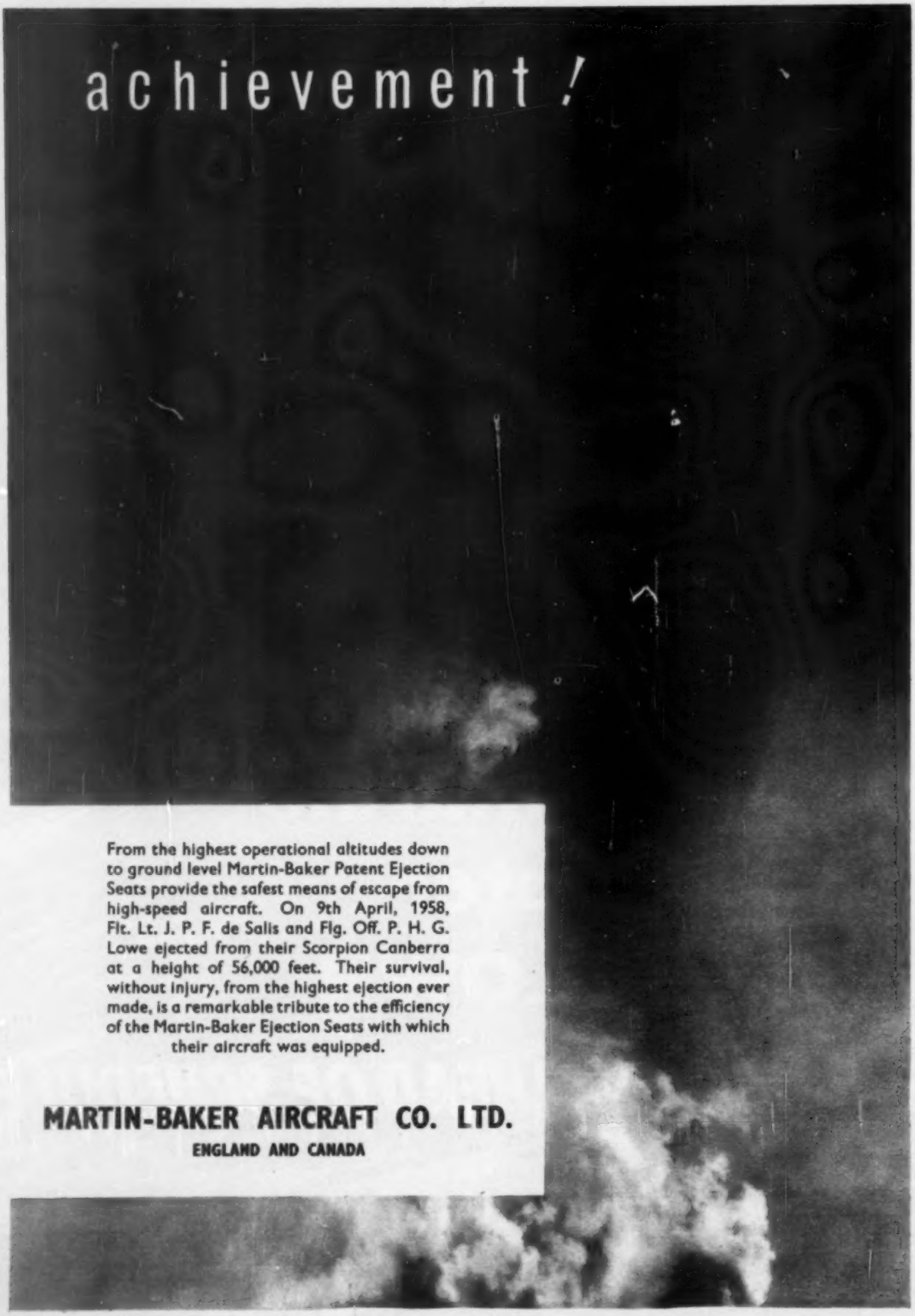

From the highest operational altitudes down to ground level Martin-Baker Patent Ejection Seats provide the safest means of escape from high-speed aircraft. On 9th April, 1958, Flt. Lt. J. P. F. de Salis and Flg. Off. P. H. G. Lowe ejected from their Scorpion Canberra at a height of 56,000 feet. Their survival, without injury, from the highest ejection ever made, is a remarkable tribute to the efficiency of the Martin-Baker Ejection Seats with which their aircraft was equipped.

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ENGLAND AND CANADA

VALIANT . . .

ing main units, each with two Dunlop wheels—having Dunlop Maxaret anti-skid braking—in tandem. Each unit has Vickers oleo-pneumatic steel shock-absorber struts and is retracted by a Rotax electric actuator incorporating "normal" and "emergency" motors. Each fairing door has two parts—the inner door, attached to the undercarriage frame and incorporating at its upper end a flap to allow for movement of the undercarriage; and the outer door, hinged at the outboard end of the wheel bay and operated by a separate actuator. If the emergency system fails to lower the undercarriage explosive bolts can be fired to sever the main up-lock brackets from the structure and the door actuators from the doors. The doors are thus allowed to open and hang freely from their hinges and the undercarriage is released so that the actuators can be operated by their motors. Nosewheel steering and mainwheel braking are electro-hydraulic.

Powerplant. All Valiants in operational service with the R.A.F. are powered with four Rolls-Royce Avon turbojets of the 200 series, delivering a thrust of at least 10,000 lb each and fed from the "spectacle" leading-edge intakes which are such a characteristic feature of the Valiant. Each Avon has a fire-extinguishing system, including detector units, spray rings and methyl bromide bottles.

Tankage is distributed throughout wings and fuselage and pressure-refuelling points are provided in the fuselage sides. The tanks have nitrogen purging, augmented by air pressure.

In addition to a built-in water/methanol system for restoring take-off power under tropical conditions or at high levels there is provision for the installation of two de Havilland Super Sprite A.T.O. rocket packs, and in the least favourable take-off conditions both water/methanol and Super Sprites would be used in combination. The Super Sprite pack contains 57 gal of 80 per cent high-test peroxide and 5 gal of kerosine, fed to the rocket chamber by compressed nitrogen. The fuelled weight of each pack is 1,925 lb and its thrust 4,200 lb for 40 sec. After take-off the pack is jettisoned and is carried clear of the airframe by two fixed negative-incidence vanes. Thereupon the G.Q. parachute-recovery system comes into play and the pack lands on air bags. A Super Sprite pack is attached beneath the powerplant bays on each side.

Services. The Valiant is very largely an "electric" aircraft. There are four 22½kW generators, each driven by one Avon. Their full output is obtainable at all engine speeds from idling to maximum take-off, and they serve the 112V D.C. system. The control lines for the instruments and power services have a 28V supply obtained from three 3kW rotary transformers driven by the 112V supply. In addition there is a 96V battery and a 24V battery, charged respectively by the generators and by the rotary transformers.

The hydraulic system operates the nosewheel steering mechanism and the mainwheel brakes. Independent electrically operated pumps supply fluid pressure. Each pump delivers fluid to the system under the control of a pressure switch and a cut-out valve, and also charges three accumulators, one for the wheel-brakes and two for steering the nosewheel.

The air-conditioning and pressurizing system is linked with the airframe thermal de-icing, bomb-bay heating, and flight-refuelling air-turbine pump systems inasmuch as the source of supply is a common one. Pressure can be adjusted to either the "cruise" or the "combat" condition. A bell gives warning that the cabin altitude has increased beyond the normal control altitudes by predetermined amounts in both conditions.

Pressurizing air is bled from a high-pressure stage of each Avon compressor and passes through ducts of stainless steel and aluminium alloy, incorporating expansion joints. The hot air is ducted from the compressors to temperature-control equipment, and it can be cooled by two separate stages. The primary stage is an air-to-air heat exchanger, or intercooler, and the secondary stage a brake turbine or refrigerator. Thence the conditioning air is fed to two floor outlets at the rear crew position and to the bomb-aimer's window, the pilots' foot warmers and the front and side panels of the windscreens. Used air is exhausted through a combined discharge and safety valve, incorporating also an inward relief valve. A "flood-flow" system is available should the cabin be pierced.

Thermal and fluid de-icing are both employed. The former serves the airframe only, and there are two fluid systems, which serve the pilots' windscreen panels and the bomb-aimer's window.

Hot air for the thermal system is taken from the same point on the engine as that for cabin pressurizing and is ducted to the wing leading edges, the tailplane, fin and engine air-intakes. The air is eventually exhausted through gauze-covered vents in the skin. Air temperature is controllable by introducing cold air through a flush intake in the bottom surface of each wing and in the leading edge of the fin. Supply is controlled by butterfly valves with electric actuators, which are operated through thermostatically controlled inching devices. The bomb bay is heated by hot air tapped off the tail unit de-icing supply.

Valiant Variants

B.1 The basic bomber type of Valiant (Vickers-Armstrongs Type 706).

B(PR).1 As B.1, but having built-in fittings for adaptation to photographic reconnaissance rôle (Vickers-Armstrongs Type 710).

BK.1 The B.1 modified for receiving fuel in flight and having built-in fittings for conversion to the tanker rôle (Vickers-Armstrongs Type 758).

BK(PR).1 The basic bomber modified for flight refuelling and having provision for conversion to the PR or tanker rôles (Vickers-Armstrongs Type 733).

B.2 A one-off prototype having a rearward-retracting bogie undercarriage housed in fairings attached to the trailing edge. Lengthened fuselage, and apparently stressed for high indicated speeds at low level.

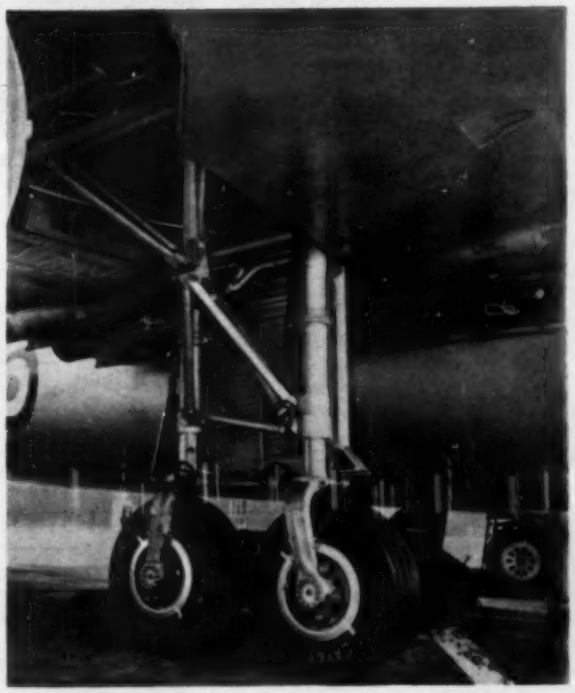
The fluid de-icing systems, to which reference has been made, are supplied from their own tanks and are independently operated by switches. Fluid flow over the windscreen is controllable by the switches to give any of three different rates; over the bomb-aimer's window it can be varied by a rheostat.

Controls. The Valiant has side-by-side dual controls with power operation. Should power supply fail, reversion to manual operation is automatic. Each flying-control circuit, that is, for ailerons, elevator and rudder, incorporates a power-control unit and an artificial feel unit in a system of rigid push-pull rods. The power units for elevator and rudder are cross-connected so that, if the generator of one should fail, the remaining one will still operate the surface at half rate. Should further failures occur, the controls automatically revert to "manual." When the hood-jettison lever is operated, the elevator controls are disengaged and the handwheel thrown forward so as not to foul the pilot's legs as he leaves in his Martin-Baker Mk 3A ejector seat.

When a control surface is moved from a trimmed setting, a restoring moment is exerted by tension in the chain connecting the cylinder piston-rod with the feel-unit lever. This tension is proportional to the square of the indicated speed, and movement of the feel-unit lever about its pivot is roughly proportional to the control deflection, so that the restoring moment—and hence the pilot's "feel"—is a function of speed and control deflection. Thus, although feel is artificial, it is similar to that obtained ideally on a manually controlled aircraft.

The screw-jack which varies tailplane incidence is rotated by one of two electric motors through a gearbox and torque-shaft drive. The motors work independently of each other, and only one at a time is selected, to give either fine or coarse drive. Flap-operation is electrical, through a motor-driven gearbox which, through torque tubes, rotates the screws in the geared flap-units.

Refuelling Equipment. The most notable Valiant innovation, since the aircraft entered R.A.F. service, is the adoption of flight refuelling—an event of considerable technical and strategic sig-



The Vickers-designed, Rotol-built main undercarriage.

VALIANT . .

nificance. The British probe-and-drogue system is used, and its application to the Valiant was undertaken by Vickers-Armstrongs working to Ministry of Supply contract in conjunction with Flight Refuelling, Ltd., originators and makers of the equipment. All Valiants in service can be modified to supply or receive fuel in flight, and many production aircraft were actually completed with the basic fittings for the tanker or receiver rôles, enabling them to be converted to tankers in a matter of hours. The receiver conversion, involving only the fitting of the probe, is completed within minutes. To convert a Valiant for service as a tanker the following operations are involved: the installation of bomb-bay fuel tank, complete with turbine pump and piping; fitment of turbine pumps in the fuselage tank cells; installation in the bomb-bay of the hose-drum unit, piping and fuel pump; fitment of a bomb-bay fairing, wing stalks and underwing tanks; and installation of the fuel-transfer control panel in the cockpit.

The operational sequence is as follows: At the start the tanker Valiant trails the hose to its full length (some 90ft). To resist air loads on the drogue an electric motor is geared to the hose drum via a fluid coupling, and tends to wind the hose back on to the drum. The drogue, however, gives a set load for a given airspeed. This load is in excess of the "wind-in" load of the hose unit, and consequently the hose trails to its full length. If the drag is reduced, the motor winds in the hose on the drum and any slack is taken up.

The receiver Valiant flies the probe into the drogue at a relative speed of 2 to 4 knots, and proceeds to close on the tanker. The surplus hose is then being wound back on to the hose drum. When the receiver is in the refuelling position, which will be indicated on the tanker control panel, the tanker operator switches on the fuel valve. Provision is made for de-icing the probe before contact and for earthing the difference of electrical potential between the two aircraft on initial contact.

After completion of refuelling the receiver aircraft falls back to the limit stop at full hose-extension. At this point the load on three spring-loaded toggle arms, which closed on to the refuelling probe on contact, will be increased until the break-away load is reached. The refuelling cycle is then complete.

In spite of the large amount of experience gained with other types of tanker and receiver, many particular problems had to be resolved with the Valiant installation before the system could be considered proven up to the operational standard required.

For fuel booster pumping, air turbines were chosen, using air tapped from the engine compressors. Tappings from each engine had already been provided into a common feed to cater for pressurization and de-icing and are now extended to fuel transfer.

The technique for hose trailing took some time to perfect. Initially it was decided to open the bomb doors on the tanker and trail the hose. This at first proved unsuccessful, owing to buffeting and vibration of the hose drum unit. This trouble was cured and a trials receiver aircraft was brought in close to the trailed hose. Turbulence over the receiver aircraft from the open bomb-bay of the tanker was severe, and a bomb-bay fairing as now fitted to tanker aircraft was evolved.

A great deal of development was required before the length of probe and type of drogue was finalized, since turbulent air behind the drogue was causing vibration problems on the receiver and difficulty in making contact at the required airspeeds was encountered. Several main drogue types were investigated. Solid and perforated cones of various angles were tried. Some models were tunnel-tested, using fuel as the medium, to study flow patterns through and around the drogue. The final drogue configuration is a generously slotted cone.

VICKERS-ARMSTRONGS VALIANT BK.1

Four Rolls-Royce Avon 200-series turbojets

Span, 114ft 4in; overall length (without refuelling probe), 108ft 3in; height, 32ft 2in; tailplane span, 40ft 9in; wheelbase (to mid-point between legs), 24ft 8in; track, 28ft; mainplane root chord, 35ft 6in; gross wing area, 2,362 sq ft; gross area of horizontal tail, 380.5 sq ft; gross area of vertical tail, 263 sq ft; gross weight, greater than 120,000 lb; speed, high-subsonic.

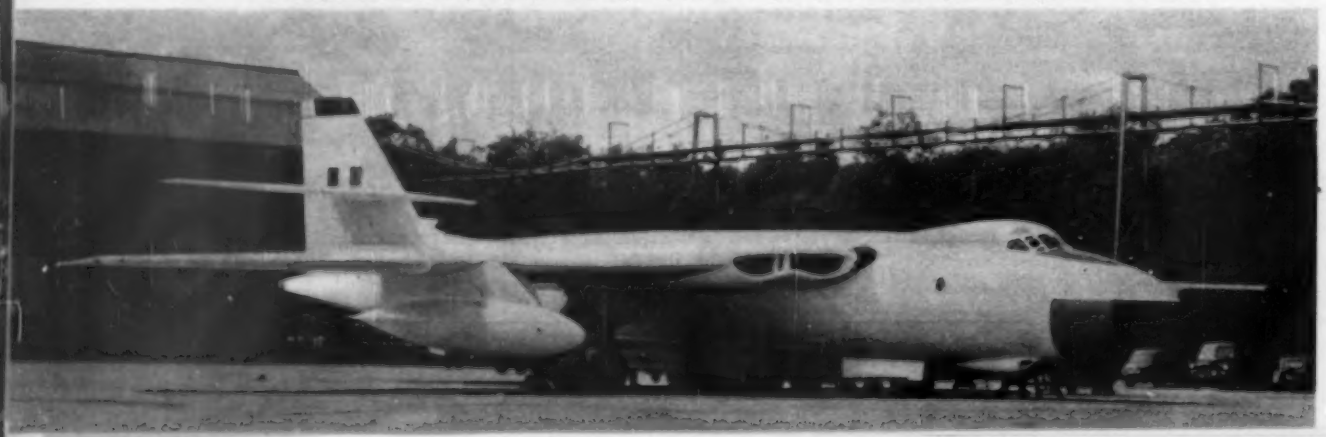
MATERIAL AND COMPONENT SUPPLIERS

The following is a list, provided by the manufacturers of the aircraft, of firms who have sub-contracted for Valiant components, or supplied materials or parts. They do not claim that the list is a comprehensive one.

Sub-contracts.—Alltools, Ltd., bomb cell roof, nosewheel structure, wing stalks, under-wing tanks, flaps, lower fin, undercarriage side stays; Altus Engineering Co. (Corsham), Ltd., machining (various), machined assemblies; Brooklands Engineering Co., Ltd., flap guide-rails, machining (various); H. V. Burlingham, Ltd., tailplane, top fin; Cramic Aircraft Components, Ltd., web plates, machining (various); Disc, Ltd., machining (various); Eastmead Engineering Co., Ltd., magazine boxes and lids, battery floor, small sheet-metal assemblies; Farnham Engineering Works, Ltd., machining (various); Field Aircraft Services, Ltd., camera crates, etc.; Franco-British Electrical Co., Ltd., control rods, etc.; R.H.R. Franks, machining (various); E. J. Guy, Ltd., pipes (various); C. E. Harper Aircraft Co., Ltd., nosewheel doors, ground equipment; Henderson Safety Tank Co., Ltd., de-icing tanks, etc.; W. Henshall and Sons (Addlestone), Ltd., ducting, bulkheads, sheet-metal sub-assemblies, etc.; Hercules Engineering Co., Ltd., bomb racks, undercarriage side stays, machining (various), machined assemblies, sheet-metal sub-assemblies, pipes (various); Heston Aircraft and Associated Engineers, Ltd., intake tunnels, flap units, bomb-bay fairings; G. Johnson Bros., Ltd., ducting, sheet-metal sub-assemblies; Leverstart, Ltd., valves, machining (various); Lever (Tolworth), Ltd., valves, ground equipment, machining (various); Marshalls' Flying School, Ltd., ground equipment test, boxes; Marston Excelsior, Ltd., radomes, fuel tanks; North Kent Panels, Ltd., panel wheeling; S. E. Opperman, Ltd., flap-unit gearboxes, machining (various); J. T. Prince Engineering Co., Ltd., ground equipment; Rotol, Ltd., main undercarriage, nose undercarriage, flap gearboxes, dive-brake gearboxes; Royston Engineering Co., Ltd., tail cone, radome, sheet-metal (various); Saunders-Roe, Ltd., scanner bonnet, pressure cabins, bomb doors, deflectors, ailerons, rudders, elevators, flying controls; C. F. Taylor (Metal Workers), Ltd., vent ducting, de-icing ducting, falseworks, dorsal fin, overload tanks, water methanol tank, ducting; T. and T. Tubecraft, Ltd., pipes (various); Turner and Savage, Ltd., air intakes, ducting; Universal Equipment Co. (Northolt), Ltd., ground equipment, etc.; Vernons Industries, Ltd., radio crates, etc.; Western Manufacturing (Reading), Ltd., drop-hammer pressings; Westnor Coachworks, ducting, etc.; Wincanton Transport and Engineering Co., Ltd., ducting, sheet-metal (various).

Equipment.—Aircraft Patents, Ltd.; Atkins Laboratories, Ltd., aerials; British Thomson-Houston Co., Ltd., electrical equipment; Bell Precision Engineering Co., Ltd.; Boulton Paul Aircraft, Ltd., powered controls; Burgess Products Co., Ltd.; C.W.C. Equipment, Ltd.; E. K. Cole, Ltd., radio; Cossor, Ltd.; J. A. Crabtree and Co., Ltd.; Didsbury Engineering Co., Ltd.; Dowty Equipment, Ltd.; Dunlop Rubber Co., Ltd., wheels, brakes, etc.; E.R.S. (London), Ltd., connectors; E.M.I., Ltd.; Ericsson Telephones, Ltd.; Export Packing Service, Ltd.; Ferranti, Ltd.; Films and Equipments, Ltd.; Flight Refuelling, Ltd.; G. Q. Parachute Co., Ltd.; Girdlestone, Grundy and Partners, Ltd., connectors; Sir George Godfrey and Partners, Ltd.; Graviner Manufacturing Co., Ltd., fire extinguishers; Harley Aircraft Landing Lamps, Ltd.; Hendrey Relays, Ltd.; Integral, Ltd.; Irving Airchute of Great Britain, Ltd.; Johnson and Phillips, Ltd.; Kelvin and Hughes, Ltd.; George Kent, Ltd.; Walter Kidde Co., Ltd.; Long and Hambly, Ltd.; M. B. Metals, Ltd.; M. L. Aviation, Ltd.; Marconi's Wireless Telegraph Co., Ltd., radio; Martin-Baker Aircraft Co., Ltd., ejection seats; McMichael Radio, Ltd., radio; Louis Newmark, Ltd., auto-stabilizer; Newton Bros. (Derby), Ltd., electrical equipment; Normalair, Ltd.; Norbury Watch Co., Ltd.; Oldham and Sons, Ltd., accumulators; Peto Scott, Ltd.; Plessey Co., Ltd.; R.F.D. Co., Ltd.; Rolls-Royce, Ltd., engines; Rotax, Ltd., electrical equipment; SPE Co., Ltd.; Smiths Aircraft Instruments, Ltd.; Teddington Aircraft Controls, Ltd.; Triplex Safety Glass Co., Ltd.; A. Wells and Co., Ltd.

A late-production Valiant BK.1 with D.H. Super Sprite A.T.O. packs and under-wing-tanks in place on their "stalks."



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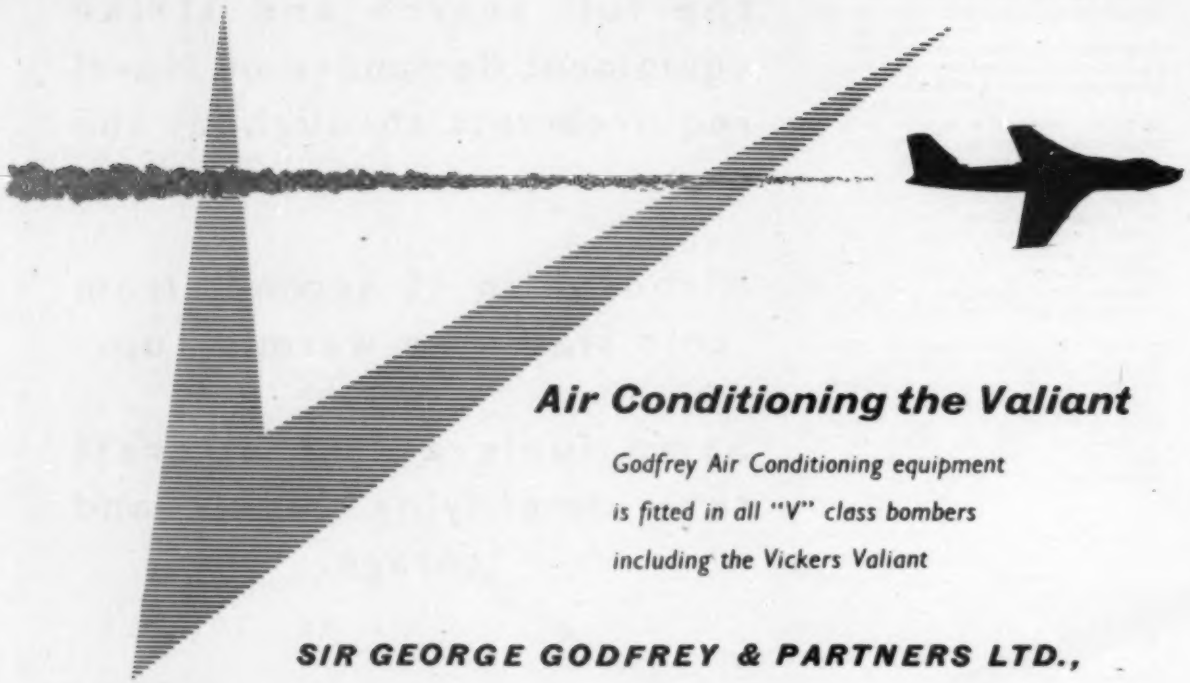

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Straight and Level

"THIS is a subject which should be thoroughly examined," said the Minister on June 18, referring to the jet *v.* turboprop fare differential. "It is," he went on, "bound to be raised at the I.A.T.A. conference later this year."

Yes, it will be raised; and I hope it will be raised by B.E.A. and B.O.A.C., with the full support of the British Government.

This is not just a matter of justifying the large British investment in the turboprop, necessary though this is. It is more a matter of relieving the air transport industry from speed-competition. I am not saying that speed is necessarily expensive (I only *think* it is). All I am saying is that the worship of speed is expensive, because it creates a demand for something newer and faster before the existing plant has paid for itself.

The fare differential issue will certainly make the I.A.T.A. machinery creak; but may I make a small, lubricating suggestion? The case for the fare differential must not be based upon the propeller's alleged lower operating cost. You can't yet prove this; and such arguments only make jet hackles rise. The case for the fare differential is simply this—lower quality must be sold at a lower price.

● How good it is of the (U.S.) Aircraft Industries Association to point out that it is only lack of drive and money which has held up piloted space flight. They are good reasons. If we had *enough* drive and *enough* money we could evacuate Russia's atmosphere and let Communism suffocate. You can explain anything by saying there isn't enough drive and money being put into it.

● I can scarcely recall a single instance of a Rolls-Royce aero engine which did not eventually yield powers far in excess of those for which it was originally designed. But surely no other engine can match the record of the Dart. Let me quote from *Flight* of April 17, 1947:—

> "Two Rolls-Royce gas turbines may also be mentioned, namely, the Clyde I and Dart I. . . . The Dart I (1,000 b.h.p.) is ready for flight trials. . . ."

And now from our issue of June 27 last:—

> "It is announced by Rolls-Royce, Ltd., that a Dart RDa.10 has successfully completed a 25-hr flight approval test at a military rating of 3,200 s.h.p."

Could Sir George Edwards now produce a single-engined Viscount?

● Lots of American Air Force and Navy crews are doing line-of-duty flying in aircraft fitted with stinger tails, magnetometers and other devices. These electronic installations can often be used in geophysical survey and prospecting, and I was amused to hear that several crews of a B-47 Wing of Strategic Air Command have filed claims to possible uranium-bearing locations as a result of prospecting during air exercises. What may we expect from our re-equipped Shackletons?

● When I first heard that the Boeing RB-47K could measure wind velocities and directions during weather reconnaissance missions I did not immediately appreciate that this must be done by a box of tricks linking drift and ground speed with true airspeed. One can all too readily visualize a crew reporting a (relative) wind of 400 knots.

● Hats and garden parties go well together; so, having recently illustrated the bowler hat incident at the Helicopter Association Garden Party, I now cap it with a top-hat incident at the Royal Aeronautical Society Garden Party.

As the Fairey Swordfish (pilot: P. Twiss) flew past *Flight's* camera, off blew the top hat worn by Lt-Cdr. W. H. ("Butch") Barnard, R.N. Quite by chance, he happened to have a spare with him, so all was well.

● Few things delight me more than an old aeroplane well restored. The Gloster Gladiator, for example, gave me acute pleasure when I saw it at the recent R.Ae.S. Garden Party. Glosters have taken immense care to ensure the authenticity of its squadron markings, as readers of *Flight's* correspondence columns will have noted.

I still hope that Gloster's sister firm, Hawker, will do something about their Hurricane, *The Last of the Many*. It looks so wrong in blue and gold, and with a civil registration—especially alongside the 1940-camouflaged Spitfire which it dog-fought at the Garden Party.

● Sometimes the basic law of supply and demand seems to get a bit unrealistic. A Minister of the Church once asked me where an evangelical mission could obtain a helicopter "for about £5,000," which could be used for difficult work in the Australian outback. Hands up anybody who sincerely believes that mankind will ever, at any time in the future, have a really capable VTOL device on the market for £5,000 (and I don't mean a pogo-stick).

● I see that, as the result of the collision menace, the American Civil Aeronautics Authority has ordered its 92 aircraft to be daubed liberally with Day-Glo fluorescent paint. A good idea and one which is already quite widely adopted by private owners in the U.S.A. and Canada. Spend a day browsing around Vancouver airport, as a *Flight* colleague did recently, and you will see very few among the hundreds of light aeroplanes which inhabit the place without a splash of orange Day-Glo somewhere—usually on the fin, wingtips and spinners. It literally stands out a mile. It lasts, doesn't cost much, is attractive, and *may* just mean the difference between life and death.

Five U.S. airlines are thinking of using it, and one—New York Airways—has already got the Quantacolor Company of New York to apply Day-Glo to its new fleet of five Vertol 44 helicopters.

● This is what Sir Arthur Vere Harvey said in the Commons recently: "Apart from a little support the Herald has had no real help. This is beyond my comprehension when Fokkers, who are building the only real competitor, have orders from their Government. It is not possible to sell an aeroplane abroad today unless initial orders have been placed in one's own country."

It is odd that Sir Arthur should have said these things, because the Friendship is the one aircraft that has shown that it *is* possible to export an aeroplane without a home market. The Friendship has no home orders worth moralizing about. K.L.M. ordered two at one stage, but have since cancelled them. The Dutch Government have ordered one.

Yet 120-odd Friendships have been sold to 33 airlines and operators—not bad going for an aircraft not yet in service. And this was not the result of the government order for one aircraft.

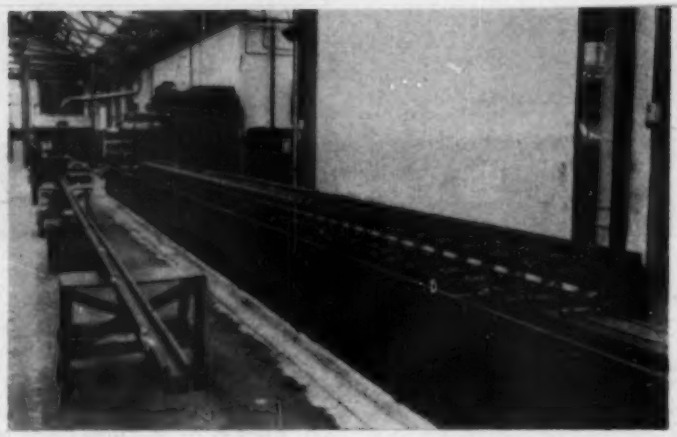
● I hear that, as from 0300 hr New York time on June 15, Greenwich Mean Time was used, and will henceforth always be used, for America's domestic air transport operations.

I reckon it is Greenwich Mean Time that we started to charge the world royalties on the use of G.M.T.

● Definition of flap-blowing: "Fooling the wing into thinking it's flying."

ROGER BACON

THE INDUSTRY



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IN his letter in *Flight* for June 20, Mr. Sawers points out that the conflict of evidence with regard to my father's first flight is confusing, and thinks that his 1908 flights were possibly not claimed as such because he may have been aided by the downhill gradient of the banking at the end of the finishing straight at Brooklands. On the other hand, my father and several of his witnesses state that this was not the case.

I am certain, after many talks with my father, that the conflict of evidence was undoubtedly caused by my father himself, and I will try to explain how this arose.

My father took his biplane to Brooklands in September 1907, and was convinced he would win the £2,500 prize for being first to fly round the track before the end of 1907. As the year drew to an end and he realized that with his 9 h.p. engine he could not get his biplane airborne, in his estimation he had *failed*. But there was still a £1,000 prize for, I believe, being the first to fly a mile, and if he could win this he would have sufficient funds to carry on with his experiments.

From his experience (i.e., taxying trials, etc., and towed flights) he was convinced that it was *only* lack of horse power which was preventing him from achieving success. When, therefore, in May 1908 he was able to borrow a 24 h.p. Antoinette engine he again thought success would be his. But the best he was able to achieve were several "hops" around 100-150ft, when he was told to quit the track in July 1908. Bearing in mind that he considered he had once again failed, is it so strange that he wrote to Wilbur Wright and said: "In all I managed to get six trials since receiving the 18-24 h.p. Antoinette engine last May, and *was fast making progress* when I had to leave in July . . ." (and *not*, as he is sometimes, perhaps intentionally, quoted as saying, "In all I managed to get six trials. . . . I managed to make several flights towed by a motor car.")? I would not have been surprised if he had described the trials as failures, for I have been told that although he was very excited that the machine had got off the ground, he repeatedly described his experiments as failures.

On leaving Brooklands he had to return the Antoinette, but those short hops he had achieved had again convinced him he could fly successfully even with his 9 h.p. J.A.P. if he had a much lighter machine with a much higher aspect-ratio. But once again in his estimation he failed, as the best he could achieve by June 1909 were hops of 50ft or so, and with his capital exhausted he wrote in *Flight* on June 26, 1909 that he would have preferred to let the fact that he had been making dozens of short flights—"true, they are hardly more than jumps"—leak out by winning the prize he had tried so hard to secure. This letter was written to try and interest someone in financing further experiments on his *triplane*, and I do not believe that it would have helped if he

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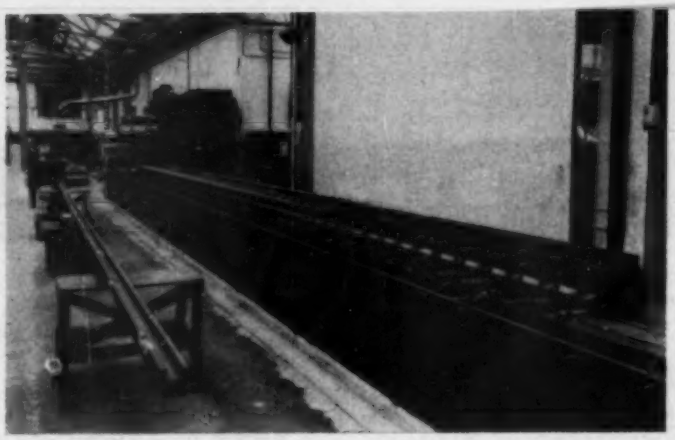

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This snapshot group, sent by Mr. Broomfield (letter above), shows some of the surviving witnesses of S. F. Cody's 1908 flights. Left to right: Mr. Broomfield, Mr. V. Cody (the pioneer's son), Mrs. V. Cody and Mr. Robb. The last-named was S. F. Cody's carpenter.

—and A. V. Roe's Flights

IN his letter in *Flight* for June 20, Mr. Sawers points out that the conflict of evidence with regard to my father's first flight is confusing, and thinks that his 1908 flights were possibly not claimed as such because he may have been aided by the downhill gradient of the banking at the end of the finishing straight at Brooklands. On the other hand, my father and several of his witnesses state that this was not the case.

I am certain, after many talks with my father, that the conflict of evidence was undoubtedly caused by my father himself, and I will try to explain how this arose.

My father took his biplane to Brooklands in September 1907, and was convinced he would win the £2,500 prize for being first to fly round the track before the end of 1907. As the year drew to an end and he realized that with his 9 h.p. engine he could not get his biplane airborne, in his estimation he had *failed*. But there was still a £1,000 prize for, I believe, being the first to fly a mile, and if he could win this he would have sufficient funds to carry on with his experiments.

From his experience (i.e., taxying trials, etc., and towed flights) he was convinced that it was *only* lack of horse power which was preventing him from achieving success. When, therefore, in May 1908 he was able to borrow a 24 h.p. Antoinette engine he again thought success would be his. But the best he was able to achieve were several "hops" around 100-150ft, when he was told to quit the track in July 1908. Bearing in mind that he considered he had once again failed, is it so strange that he wrote to Wilbur Wright and said: "In all I managed to get six trials since receiving the 18-24 h.p. Antoinette engine last May, and *was fast making progress* when I had to leave in July . . ." (and *not*, as he is sometimes, perhaps intentionally, quoted as saying, "In all I managed to get six trials. . . . I managed to make several flights towed by a motor car.")? I would not have been surprised if he had described the trials as failures, for I have been told that although he was very excited that the machine had got off the ground, he repeatedly described his experiments as failures.

On leaving Brooklands he had to return the Antoinette, but those short hops he had achieved had again convinced him he could fly successfully even with his 9 h.p. J.A.P. if he had a much lighter machine with a much higher aspect-ratio. But once again in his estimation he failed, as the best he could achieve by June 1909 were hops of 50ft or so, and with his capital exhausted he wrote in *Flight* on June 26, 1909 that he would have preferred to let the fact that he had been making dozens of short flights—"true, they are hardly more than jumps"—leak out by winning the prize he had tried so hard to secure. This letter was written to try and interest someone in financing further experiments on his *triplane*, and I do not believe that it would have helped if he

CORRESPONDENCE . . .

had said he had made longer hops on a *biplane* a year previously.

I shall, therefore, be surprised if contemporary accounts can be found describing those early hops, since my father at the time did not consider them anything more than stepping-stones to his goal, and certainly nothing worth writing to the Press about. It was only later, when he realized just how difficult it was to master the art of flying, and that others were claiming lesser hops as flights, that he attached any importance to them, and sought out those who had seen him make those early hops and filed their evidence with the R.Ae.C.

Warsash, Hants. G. VERDON-ROE.

THE answer to Mr. Sawer's letter (*Flight*, June 20) as to whether there were aeronautical activities at Hendon and Eastchurch in 1908 is "Yes."

C. R. Fairey was born at Second Avenue, Hendon, where he lived until his father died when he was 15. Fairey was intensely interested in model aircraft and in this fashion met A. V. Roe and the Short brothers. Anyone with the slightest knowledge of model enthusiasts will know that *everything* is discussed in detail. As for Eastchurch, taken as a generic term, this was in aeronautical flower even long before 1908, under the Short brothers' banner.

Apropos Cody, may I ask another question? Who was the first man (or boy) to ascend in his man-lifting kites? The late Sir John Boothman and Capt. Duncan Davis certainly had a "ride": but who was the first intrepid birdman?

London, W.1. B. J. HURREN.

Early Rocket Propulsion

IN Roger Bacon's column "Straight and Level," which I read every week with great interest, I find in the issue of May 30 the dates of the first flights which were achieved with different propulsion systems mentioned.

Point (2), the first flight by a man-carrying aeroplane powered by jet reaction, is not correct. The first flights with rocket propulsion took place on the Wasserkuppe on June 11, 1928, with a research glider "Ente" (canard) flown by Herr Fritz Stamer. You will find a report of these first tests with rocket propulsion in the *Zeitschrift für Flugtechnik und Motorluftschiffahrt Z.F.M.* 1928, 12 Heft (issue), pages 270-274. Especially interesting is Section B of the report, which is a description of the flights by the pilot himself.

The flight of Herr Fritz von Opel which your contributor mentions is therefore not the first flight with reaction power. The test flights on the Wasserkuppe were witnessed by several people, and the rockets were supplied through Herr von Opel. All this is described in detail in the report. I witnessed these flights myself; and the pilot, Herr Fritz Stamer, is still alive and is at the present time the general secretary of the German Aero Club, Frankfurt-am-Main.

On the question of the memorial at Hanover Airport, more information could be found in the book by Rumpler, *Flugmaschinen*, a very comprehensive description of all early aircraft, where this aeroplane by Herr Jatho is shown in pictures and his tests are described. As far as I remember this so-called flight is of the same order as the Frenchman Ader's flight in the 1890s. The Rumpler book contains also some information about the helicopter tests of Cornu.

Cedar Rapids, Iowa. A. M. LIPPISCH.

[Dr. Lippisch is famed for, in particular, his design of gliders (mainly in Germany in the inter-war years), early delta-wing aircraft and Messerschmitt rocket-propelled fighters. In 1946 he became consultant to the U.S. Air Materiel Command, and is still working in America —Ed.]

More About Jatho

WITH reference to Roger Bacon's query (May 30) and Mr. Voaden's suggestion (June 20), Supf's *Das Buch der deutschen Fluggeschichte* has much on Jatho, of which the following may be most pertinent (Vol. I, p. 249):—

"Er hat am 18. August 1903 in der Vahrenwalder Heide, nordlich von Hannover, mit einem selbstgebauten Dreidecker den ersten Flugsprung uber deutschem Boden von 18 Meter Lange in dreiviertel Meter Hohe ausgefuhrt. Und noch im November des gleichen Jahres gelangen ihm mit einem Zweidecker Sprunge bis zu 60 Meter Lange und in Hohen von zweieinhalb bis dreieinhalb Meter."

London, W.1. F. H. SMITH,
Librarian, the Royal Aeronautical Society.

Air-transportable A.F.V.s

I THINK there is a small A.F.V. correction to your excellent "Military Aircraft" special issue: the "AMX medium tank" to which you refer under Bréguet 765 (p. 855) is, in fact, the *light* AMX of 13 tons, an air-transportable light tank conceived as such in 1946 and still the only such tank in service—incredible isn't it?

London, S.W.7. R. M. OGORKIEWICZ.

Outsize Dept.

IN your civil aviation section of the June 13 issue, under the heading "Herons Migrating," you say ". . . can perhaps be seen as not so much a reflection on the aircraft as on the operator." (New Zealand, Indian, Indonesian, Japanese, etc.)

One is reminded of a recent humorous Press reference to the ladies' dresses department of a large store, where the salesgirls remark that "the customers do come in silly sizes, always wrong."

London, W.8. P. E. TREMENHEERE.

[Our implication was that airliner customers demand different fittings and styles as they put on age—and weight.—Ed.]

Anglo-Canadian Satellite?

IT apears to be generally recognized in aeronautical circles in both this country and Canada that, given sufficient money, either nation would be capable of putting a satellite into orbit.

The vast expense seems to be the only barrier to both projects. Surely, then, what is required is a joint Anglo-Canadian earth-satellite programme. Since the cost and the necessary scientific staff would be shared by both nations, it should not prove to be a great burden on the economies of either nation. The prestige gained would be a great help in selling British and Canadian aircraft, and in offsetting the disappointing results of Zeta. If it is not carried out the aircraft industries of both nations are doomed.

Northwich, Cheshire. M. S. BRADBURY.

Forecasters—and Soothsayers

IN your May 16 issue, so rightly devoted on one hand to a fascinating glimpse of the near future of many important aspects of our aviation world and on the other to honouring one of its practical pioneers, I was delighted to find that its only perceptible joke had an even more sturdy ancestry. [This was Roger Bacon's remark about one air traffic forecaster being unable to meet another without laughing.—Ed.]

Forecasting of any sort has always had its detractors, and Cicero was one of the more prominent.

Hounslow, Middx. J. R. C. YOUNG.

[Actually, Roger Bacon's quotation was plagiarized from Cato, who was quoted by Cicero in *De Divinatione*: "Cato used to say that he wondered why one soothsayer did not laugh when he saw another"—Ed.]

Another for the Historical Record

IN daily Press reports on the closing of Tangmere it was stated that I discovered Tangmere in a forced landing in 1917. That error arose from the Air Ministry hand-out. So, for the benefit of future historians who may also cull their history from ancient Press files, let's get this straight before it's too late. My first landing at Tangmere was in 1916, *not* 1917: November 19, 1916, as is rightly stated on the brass plate on my propeller at Tangmere.

London, S.W.5. GEOFFREY DORMAN.

FORTHCOMING EVENTS

July 4. College of Aeronautics Students' Society: Presentation Ball, Cranfield.
July 5. NATO Air Display: Soesterberg, Holland.
July 5-6. Aéro Club de l'Ouest: Anjou Wines Rally.
July 5-7. R.Ae.C.: Private Air Rally, Deauville.
July 8. Kronfeld Club: Welcome home to British gliding team.
July 8-11. Institute of the Aeronautical Sciences: National Summer Meeting, Los Angeles, Cal.
July 10-12. R.Ae.C.: National Air Races and Lockheed International Aerobatic Competition, Baginton, Coventry.
July 12-14. Royal Dutch Aero Club: Camping Rally.
July 13. Wolverhampton Aero Club: At Home, Wolverhampton.
July 13. Leicestershire Aero Club: At Home, Leicester East.
July 16. Kronfeld Club: "The London Gliding Club," by Dudley Hiscox.
July 19. R.N. Air Stations Eglinton (Londonderry) and Culdrose, nr. Helston, Cornwall: At Homes.
July 19-20. Calvados Aéro Club: Caen Rally.
July 26. R.N. Air Station Lossiemouth: At Home.
July 26-27. Trento and Bolzano Aero Clubs: Dolomites Circuit.
July 26-Aug. 4. B.G.A.: National Soaring Week.
Aug. 1-16. Czech Aero Club: World Parachute Championship, Bratislava.
Aug. 2. R.N. Air Station Brawdy, nr. Haverfordwest: At Home.
Aug. 2-4. Plymouth Aero Club: Rally.
Aug. 2-5. S.M.A.E.: Model Aircraft World Championships, College of Aeronautics, Cranfield.
Aug. 3-4. Leinster Aero Club: Display, Weston, Co. Kildare.
Aug. 9. R.N. Air Stations Yeovilton and Lee-on-Solent: At Homes.
Aug. 16-17. Alsace Aero Club: Rally des Vins, Alsace.
Aug. 31. Oxford Aeroplane Club: At Home, Oxford Airport.
Sept. 1-7. S.B.A.C. Display and Exhibition, Farnborough.
Sept. 8-13. First International Congress of Aeronautical Sciences, Madrid.
Sept. 21. B.G.A.: National Sailplane Aerobatic Contest, Dunstable.
Sept. 21. Royal Belgian Aero Club: 300 cu m Balloon Competition.
Sept. 21. Milan Aero Club: Rally.
Sept. 26-29. Austrian Aero Club: Innsbruck Rally.

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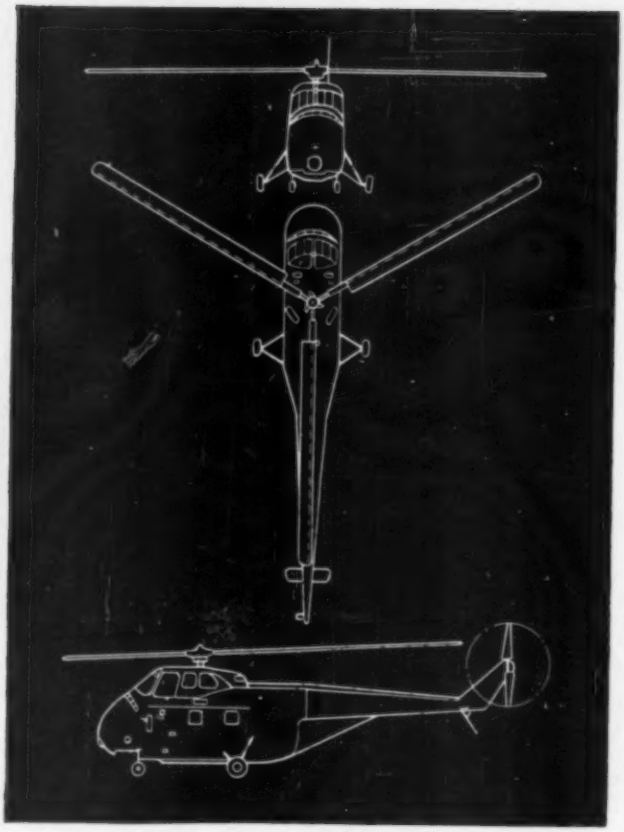

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Westland Whirlwind cockpit (Photograph by courtesy of B.E.A.)

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TSA RHA 47

At the R.A.F.S.A.A. Bisley meeting, reported below. Left to right, A.V-M. J. G. W. Weston, chairman of the Association, watches the firing with Air Chief Marshal Sir Ronald Ivelaw-Chapman; W/C. Thomas, R.A.F. rifle champion and winner of the Queen's Medal, waiting to be borne off with musical honours; A.V-M. A. F. Hutton, with G/C. W. J. Macken as spotter, firing in the air officers' sub-machine-gun match, which he won; the scene on the range during the 300 yd rapid fire in the final stages of the Service rifle championship.

"Flight" photographs

SERVICE AVIATION

Royal Air Force and Naval Flying News

A.D.C. to the Queen

THE *London Gazette* for June 24 announced that the Queen has been graciously pleased to approve the appointment of A. Cdre. R. N. Bateson as A.D.C. to Her Majesty, and of A. Cdre. H. Keggin as Honorary Dental Surgeon. These two officers succeed, respectively, A. Cdre. R. C. Mead and A.V-M. M. J. Pigott.

Bomber C-in-C. in Rhodesia

ON Wednesday of last week Air Chief Marshal Sir Harry Broadhurst, A.O.C-in-C. Bomber Command, left R.A.F. Station Waddington in a Vulcan in response to an invitation by the Government of the Federation of Rhodesia and Nyasaland to visit those countries and have talks with Ministers and with senior officers of the R.R.A.F. One of the subjects discussed was the equipment of that Service with Canberras early next year. The aircraft arrived at Salisbury, Rhodesia, on the following day after flying *via* El Adem and Embakasi.

Lady Broadhurst also made the trip, travelling in a Comet of Transport Command. Both she and Sir Harry were due to return in their respective aircraft last Tuesday.

R.A.F.S.A.A. Bisley Meeting

THIS year the Bisley meeting of the R.A.F. Small Arms Association lasted a fortnight instead of the usual week, the championship and Command meetings having been combined. Contestants were limited to 975 in number because of difficulty in manning the butts.

Weather was variable. On the final day, during which several important matches were decided, there was both rain and sun, but very little wind.

Competition for the Queen's Medal became intense when it was realized that there were no fewer than three previous winners in the top ten of Stage 1. These were F/L. M. Gill, last year's winner; Sen. Tech. B. Creasey, 1955; and Ch. Tech. J. E. P. Witts, who won the medal when it was first instituted in 1953. The prize eventually went to W/C. Thomas (Hornchurch) with a score of 352—only the third occasion on which the champion's points have exceeded the 350 mark. Second was S/L. James (Chivenor), 351; and third was Ch. Tech. Witts (Swanton Morley), 349.

The invitation sub-machine match for guest officers of air rank was again a feature of the meeting; and the first prize, a miniature Sterling sub-machine-gun, went to A.V-M. A. F. Hutton, Director-General of Engineering, Air Ministry. A. Cdre. Murphy, Maintenance Command, was runner-up. The Rothermere Shield this year was won by Bomber Command with Fighter and Flying Training Commands second and third respectively. Results of some other main matches were:—

Revolver Championship: F/L. Davies, 193 pts; Ch. Tech. Ilsley, 190; P/O. Pickles, 188. *Sub-machine-gun Championship:* S/L. Williams, 302; P/O. Greig and S.A/C. Hardiman, tied 297.

Command Team Match (S.R.a): Bomber Command, 1,300; Fighter, 1,298; Far East Air Force, 1,285. *Command Team Match (S.R.b):* Flying Training, 1,101; Far East, 1,095; No. 90 Group, 1,094. *Command Revolver Team Match:* Bomber, 675; Home, 644; Fighter, 643. *Command Sub-machine-gun Team Match:* Fighter, 1,132; Bomber, 1,125; Flying Training, 1,083.

Station Team Match (S.R.a): Oakington, 947; Thorney Island, 947; St. Athan, 945. *Station Team Match (S.R.b):* Chivenor, 556; Medmenham, 554; Acklington, 548. *Station Revolver Team Match:* Wyton, 331; Little Rissington, 314; Catterick, 311. *Inter-unit Sub-machine-gun Match:* Catterick, 826; Medmenham, 801; Watton, 795.

R.Aux.A.F. and R.A.F.V.R. Challenge Cup (S.R.b): Cdt/Plt. White, U.L.A.S., 131; Cdt/Plt. Anderson, U.L.A.S., 129. *Old Comrades (S.R.b):* S/L. Willott, 138; Sgt. Prince-Cox, 137. *University Air Squadrons Match (S.R.b):* Bristol, 754; Nottingham, 704; Glasgow, 684. *Apprentices and Boy Entrants Match (S.R.a):* A/App. Barrand, Halton, 89; Ldg. B/E. Docker, Cosford, 88.

Pinecastle Postscript

AN article written by A.V-M. K. B. B. Cross, A.O.C. No. 3 Group Bomber Command, in the Vickers house journal *Vickers News* throws further light on the participation of two Valiants in the combined bombing, navigation and reconnaissance competition held by Strategic Air Command at Pinecastle A.F.B. last year.

The first Valiant squadron was formed in 1955, but lack of equipment, particularly radar bombing gear, made it impracticable to compete until 1957. Special training was actually begun in November 1956; and in June 1957 four Valiant crews began intensive training for Pinecastle on a competitive basis. The crews led by S/L. Payne and F/L. Mather gained the highest marks and were selected for Pinecastle while W/C. Oakley, who came third, went as travelling reserve. Five weeks were spent in preliminary familiarization at Pinecastle, where the Valiants aroused tremendous interest from U.S.A.F. personnel.

Altogether 86 S.A.C. crews competed, flying on six successive nights over the same route, which included an astro-navigation leg and bombing attacks against targets in St. Louis, Kansas and Atlanta. Spares and groundcrew were limited and no outside support allowed. Any aircraft taking off more than five minutes late was disqualified. *Vickers News* continues:—

"Aircraft took off at 10-minute intervals, the British aircraft taking off first. It is a high tribute to the ground crews and the manufacturers that the Valiants always took off on time and finished the competition with a 100 per cent record.

"On the first night F/L. Mather took off dead on time and was followed on the succeeding night by S/L. Payne. On both these flights the results, while not bad, were not so good as had been expected. On their second nights Mather produced some typically steady results while Payne and his crew had a magnificent night in both bombing and navigation, moving up from 47th place to 12th in the individual crew classification.

"On their last nights Payne had another excellent all-round performance and Mather's bombing results were good, but his navigation, while very adequate from an operational point of view, was not nearly good enough for the competition standard we were up against.

"In the end the team was 27th out of 45, Mather finishing 76th out of 90 crews and Payne finishing 11th, beating no fewer than 75 of the world's most expert bombing crews."

The S.A.C. crews thought the Valiants had done very well considering their relatively new equipment, unfamiliar targets and shorter training experience.

M.U.A.S. Wins D.H. Trophy

ON June 21 Manchester University Air Squadron won the de Havilland Trophy for the third year in succession, beating teams from Liverpool, Birmingham and Queen's (Belfast) University in formation, aerobatic and spot-landing sequences. The competition was flown at R.A.F. station Shawbury.

CIVIL AVIATION

LAST OF THE BIG ORDERS?

EXHIBITS filed by Northwest Airlines with the C.A.B. in connection with the impending New York - San Francisco Nonstop Case throw light on the 310,000 lb DC-8 recently announced by Douglas and described in last week's *Flight*. This appears to be the model specified by Northwest in which the JT4A-3 engines are replaced by -10s, and fuel capacity is increased to 19,306 Imp. gal. Northwest's order, reportedly in the final stages of negotiation, is apparently for five DC-8s to be delivered between March and September 1960, an option having been taken on a further four.

Northwest's exhibit also refers to ten Electras. The first of these should be received next July, and the last by the end of 1959. A further two are optioned for delivery in the spring of 1960. All these orders probably specify trade-in terms.

It is not yet known whether publication of Northwest's orders was precipitated by the need to file exhibits with the C.A.B., or if the orders were prematurely announced to strengthen Northwest's hand in the New York - San Francisco case. Whatever the reason, this carrier retains the distinction of being the last major world airline to order large jets.

MUNICH ACCIDENT FINDINGS

A FIVE-MILLIMETRE layer of ice on the wings of the B.E.A. Elizabethan G-ALZU, which crashed on take-off from Munich on February 6, is considered by the German investigating commission "to have contributed to a considerable degree to the cause of the accident." As a result of it 23 persons—including the co-pilot, Captain K. Rayment, and eight Manchester United football players—lost their lives. The senior pilot, Capt. J. Thain, survived to give evidence. The possibility that there were other contributing circumstances was not excluded, and the commission (which presented its findings on June 26) said that "all details of the course of events of the accident cannot be cleared up with certainty." The Commission consisted of Judge Walter Stimpel (a former Luftwaffe pilot) and three assessors.

Although many factors point towards wing icing causing a loss of life (the aircraft had flown from Belgrade in temperatures of −21 to −25 C; during refuelling at Munich it had been exposed to wet snow for 1 hr 46 min; and the temperature dropped to a little below zero just before the accident) these factors alone do not explain all the circumstances, in particular the possibility that there was some connection between the accident and the two take-off attempts abandoned before the final run was made. After the second attempt the aircraft was taxied to the dispatch building and the station mechanic asked for advice on a manifold pressure gauge which temporarily over-registered. The final take-off attempt by G-ALZU, along the 6,260ft runway where four or five centimetres of snow had settled upon about one centimetre of slush, is described by the commission as follows:—

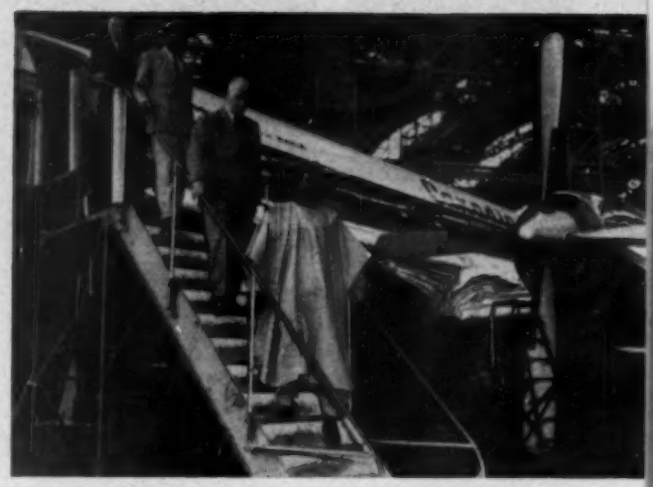
"After the engines were tested, the aircraft taxied on to the runway. With the landing-wheel brakes on, the throttles were opened and after the brakes were released the aircraft taxied farther. The aircraft increased its speed, but however was at no time airborne. It taxied along the entire length of the runway and beyond the end of it. The aircraft also continued with its landing wheels on the ground on the adjacent 885ft safety strip, which was sown with grass. A strong brake mark about 165ft long at the end of the concrete runway and partly on the adjoining grass strip indicated that for a short time the wheels were braked here, so that they locked.

"After taxying across the safety strip, the aircraft broke through a wooden fence and made a leap off a small rise in the ground. Through this its left wing struck a house. As a result of the consequent impact on the ground and owing to a fire which broke out, the aircraft was partly destroyed."

The commission in its findings exonerated flight control, the German weather service and airport installations and considered that the position of the house did not infringe I.C.A.O. regulations. Documentation and loading were in order and the aircraft's engines —tested after the accident—operated satisfactorily. A layer of ice covered with powdered snow was found on the wings after the accident; snow which had fallen during the time the aircraft was on the ground had not been removed. The ice-layer was considered to have contributed "in a large degree" to the accident.

Subsequent to the inquiry, B.E.A. expressed gratitude to the commission for "the spirit and manner in which they have conducted this investigation." The Corporation's air safety committee are to hold an early meeting to discuss the findings.

The chairman and managing director of Ansett-A.N.A., Mr. R. M. Ansett, seen at the controls of the Handley Page Dart Herald. His company's choice for a DC-3 replacement has now narrowed to the Herald or Fokker Friendship.



The Hon. Chief Samuel Akintola, Nigerian Minister of Communications and Aviation, during his recent visit to Filton to inspect the Britannia assembly hall. West African Airways are planning to acquire long-haul equipment in the near future.

BRITANNIA IN LATIN AMERICA

IT seems in these days that the way to demonstrate reliability on an airliner sales tour is to operate the aircraft to a schedule that leaves little time for anything but routine maintenance. This is a policy dictated not only by a desire to obtain the maximum value from an operation that commits an aircraft, its crew and a company's sales staff to a protracted period away from their home base, but also deliberately to demonstrate the aircraft's capability under strenuous conditions. The competitive pace of recent tours has also been increased by the comparisons that are inevitably made with other manufacturer's programmes.

Britannia G-ANCD, touring South America after giving demonstrations in Spain and Portugal, offers the most recent example of this trend. When it arrived at Sao Paulo, Brazil, on June 23, it had flown 72 hours virtually without trouble since it left Filton on June 8. The aircraft was demonstrated to Cubana de Aviacion (in whose colours it is painted), to government officials, to executives of South American airlines and representatives of the Press. Highlights of the tour included a Havana - Washington - New York - Havana flight with eight ambassadors among the passengers, a landing and take-off from the 1,700 yd runway at Aeroparque, Buenos Aires, and a record flight at a block speed of 338 m.p.h., between Rio de Janeiro and Caracas. A "tired but happy" Bristol team returned to Filton on June 30.

FLYING FOR THE PROFESSOR

THE title of this paragraph is an apt Americanism applied by Lockheed to the Electra's C.A.A. certification trials, which started on June 27. In the two months before the scheduled certification date of August 22, Lockheed will use the first and fourth Electras to be completed in an intensive programme of certification flying. The first aircraft—fitted with water ballast tanks and nearly a million dollars' worth of instrumentation—will demonstrate field length capabilities at gross weights of 95,650 and 116,000 lb, the latter being well above the guaranteed maximum take-off weight of 113,000 lb. The other aircraft will be used for "a marathon programme" of functioning and reliability tests.

Five Electras are now flying, the last off the line being scheduled for the Allison Division of General Motors Corporation. It will be used for powerplant development of the Electra's Allison 501s. In addition, more than 750 hours' engine development flying has been completed by Lockheed's turboprop U.S.N. Super Constellation *Elation*, which is doing a daily average of eight hours' simulated airline flying.

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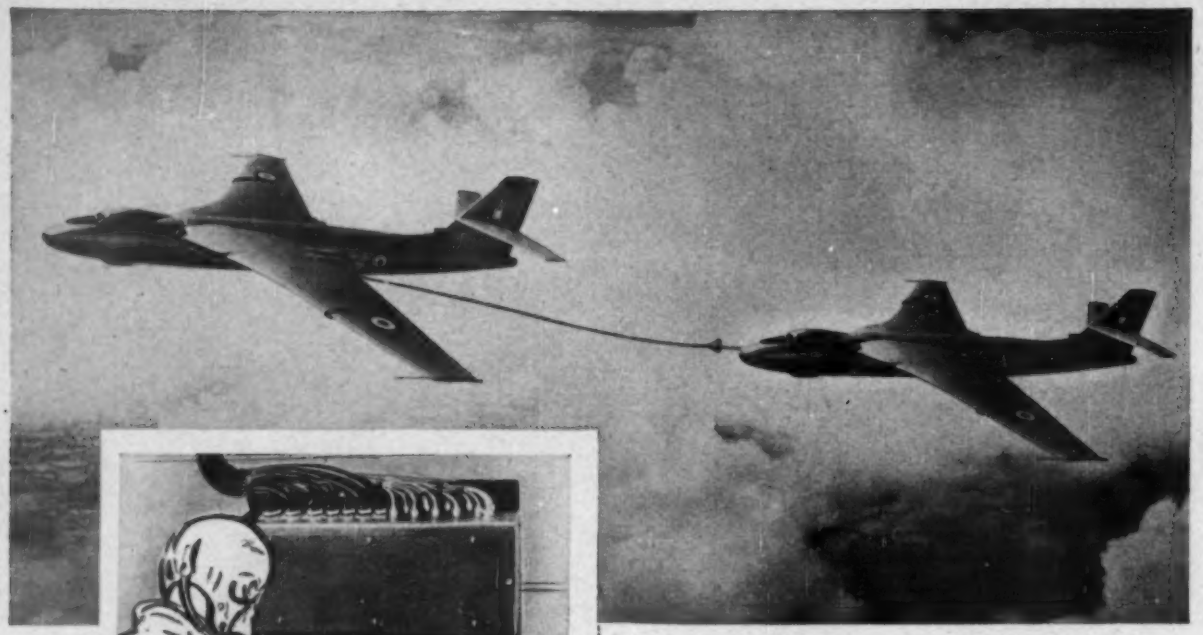
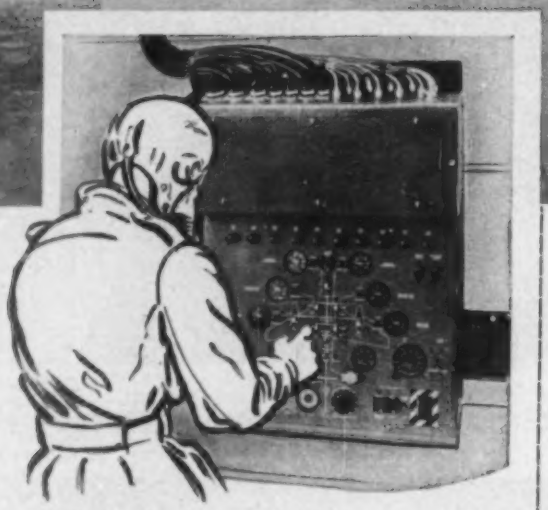




R·A·F

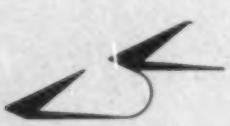
'VALIANTS'

REFUEL IN FLIGHT

Probe and Drogue adopted for V-bomber force

FLIGHT REFUELLING gives to our V-bombers advantages which stem from greatly increased range and striking power.

This valuable facility of being able to refuel in flight can be applied quite easily to most modern aircraft without structural alteration—a point becoming increasingly appreciated by other countries. (Probe and Drogue is standard equipment in fighters of the U.S. Navy and U.S. Tactical Air Force.) Conversion is simple and straightforward and the cost is agreeably low, particularly in terms of time, labour and weight. Equipment for the tanker aircraft, for example, is a self-contained "package" unit which can be fitted or removed in a few hours. Operation calls for only the briefest instruction.



Refuelling the Valiants in flight requires no addition to normal aircrews. From a remote control panel on the tanker the complete fuel transfer operation is controlled safely and semi-automatically by one man. The probe of the receiving aircraft is flown into the drogue and withdrawn when its tanks are full—the connections being made or broken entirely at the discretion of the receiver pilot.

FLIGHT REFUELLING LIMITED

TARRANT RUSHTON AIRFIELD BLANDFORD DORSET TELEPHONE: BLANDFORD 501 · TELEGRAMS: REFUELLING BLANDFORD

CIVIL AVIATION . . .

The first French-registered Viking (previously G-AJBW) bears the red, white and blue colours of G.E.C.A. Airnautic of Paris.

PHILIPPINE TWIN PIONEERS

TO meet the particular requirements of Philippine Air Lines their five Scottish Aviation Twin Pioneers will be powered with Pratt and Whitney R-1340 engines and will incorporate other modifications. The following details have been provided by the Ansor Corporation of New York and London, who are supplying the engines. The first installation is being made and the order should have been completed by the end of the year.

As already reported, the forward baggage compartment, normally located under the cockpit floor, is to be eliminated in favour of a slightly larger compartment in the rear fuselage, just aft of the cabin. It provides 67 cu ft, with a maximum weight of 700 lb—exactly double the forward baggage space, which Ansor are retaining as well. The toilet-compartment bulkhead has been moved, making that compartment slightly narrower but permitting the installation of three additional seats. Alternatively, the seats can be removed and this space also utilized for the stowing of baggage. Two extra windows have been installed at the starboard rear side.

Access to the after baggage space is via the exceptionally large door. The complete hold is metal lined and equipped with tie-down rings and lighting facilities. A radio-equipment rack has been installed aft of the hold.

The rear baggage compartment not only provides valuable extra space, but also supplies the most satisfactory answer to the problem of c.g. compensation for the heavier engines.

Other modifications in the Philippine Air Lines Twin Pioneers include numerous additional inspection or access ports and relocation of the battery. The latter permits the battery to be lowered from a redesigned compartment immediately aft of the forward baggage compartment. It can thereby be serviced from the ground without recourse to the step-ladder necessary to reach it in its former position behind a nose door.

In the modified layout the instrument panel can be quickly removed from the cockpit in three independent sections. The panel has been completely modified with American instrumentation and American-type layout. The radio to be installed is also of the latest American type, permitting a considerable weight-saving. All accessories, too, are of American type and are generally designed to be interchangeable with those used in the de Havilland Otter installation (P.A.L. operate a fleet of Otters). Two 100-amp generators are installed to give additional power.

To compensate for the increased weight of the P. and W. installation the maximum take-off weight has been increased to 750 lb greater than in the current installation. At the time the contract was signed the weights stood at 13,250 lb maximum for the Alvis-powered aircraft and 14,000 lb proposed for the P. and W. The latest weight and balance data for the P.A.L. aircraft state "with strengthened undercarriage the a.u.w. may be raised to 14,500 lb."

Engine-overhaul will be carried out by Air Engine Services (U.S.-U.K.), Ltd., in England, payment in sterling being possible.

The cost of overhauling the 1340 engine is reduced by the ready availability of spares. For example, a fixed-price overhaul of £1,000 can be given by Aero Engine Services. The engine as supplied by A.E.S. carries the equivalent of a new-engine guarantee.

The complete P. and W. powerplant, including engines, propellers and cowlings—in fact, everything from the firewall forward—is being supplied under contract by the Ansor Corporation to Scottish Aviation.

CHICAGO HELICOPTERS

CHICAGO HELICOPTER AIRWAYS have just celebrated the carriage of their 100,000th passenger. In reaching this figure in less than two years (actually in 20 months) C.H.A. have established a record rate of passenger growth. On present schedules that show a daily capacity in excess of 1,000 seats the second half of this year should see C.H.A. carrying at least 50,000 passengers to bring the year's total over 100,000. C.H.A.'s president, John S. Gleason, Jr., hopes next year to announce that the quarter-million mark has been passed.

Purchase of an additional two S-58s last spring has brought the operator's fleet up to five of these aircraft, and three Bell 47s. The three S-55s are not now in operation.

BANANA BUS

FOLLOWING the example of Elder Dempster (*Flight*, June 20), another surface carrier is preparing to participate in air transport. Two French bus operators—Les Couriers Normands and Cie. Normande d'Autobus, both subsidiaries of Société Générale des Transports Départementaux—are planning to start a joint thrice-daily service this month from Caen to Le Havre with a 15-seat Vertol 44, stops being made at Ouistreham, Cabourg, Deauville and Honfleur. In comparison with a 75-mile road journey taking 3½ hr, the Vertol 44 will reduce the distance to 31 miles and journey time to 40 minutes. Behind the proposed experimental service is M. Jean Richard-Deshais, chairman of S.G.T.D. and president of Air Algérie.

AUSTRALIA'S LARGEST AIRLINE

RELEASE of final traffic statistics by the Australian Department of Civil Aviation for the year 1957 allows observers to evaluate the contradictory claims being put forward by the major Australian carriers as to which is that country's largest airline. A look at the statistics provides both the answer to these claims and the reason for the contradictions: it all depends upon which figures appear to be taken.

Ignoring such futile indices as route network and fleet size, and concentrating on capacity offered and load carried, the following picture emerges. On the basis either of total capacity or of total load, Qantas emerges as the largest Australian airline, closely followed by Ansett-A.N.A., third place being filled by T.A.A. On a total revenue or cost basis these ratings would also probably apply.

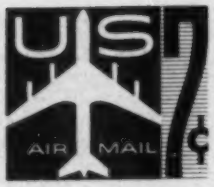
On a passenger-mile basis, Qantas leads for the first time, Ansett-A.N.A. dropping to third place on account of its relatively shorter haul character (on a counting of heads, Ansett-A.N.A. comes a comfortable first, while Qantas comes a very poor third). In 1956 all three airlines carried about the same passenger traffic. On a seat-mile basis, Ansett-A.N.A. leads narrowly from Qantas. The fields of freight and mail are dominated respectively by Ansett-A.N.A. and by Qantas.

Qantas emerged last year as Australia's largest airline. In 1956 Ansett-A.N.A. led in terms of total load carried and capacity offered.

Airline	Passengers ×1,000	Pass.-miles × mil	Seat-miles × mil	Load factor per cent	Freight L.T.M. × mil	Mail L.T.M. × mil	Total L.T.M. × mil	Total C.T.M. × mil	Load factor per cent
Ansett/A.N.A.	842	382	660	58	22	1	61	99	62
T.A.A.	811	394	567	69	10	1	51	76	66
Qantas	136	412	655	63	12	9	64	111	58

The first flight of the Agusta A.Z.8 took place recently at Malpensa, Milan. This Leonides-powered 22-26 seat transport is designed "for operating on small- and medium - range routes."

Among Gatwick's most frequent visitors are Jersey Airlines' Herons, one of which is shown being refuelled by the new Shell-Mex/B.P. "Cornwall" unit.



The U.S. postal authorities will issue this new blue and white "jet age" airmail stamp at the end of this month.

CIVIL AVIATION . . .

REGISTERING AGREEMENT

THE Air Registration Board's annual report (to be discussed in detail in next week's *Flight*) contains cheering news on the progress towards reciprocal acceptance of U.S. and U.K. certificates of airworthiness and performance requirements.

First step forward was a line-by-line comparison of British and American C. of A. requirements which "brought to light some hundreds of differences between the codes." Following on the visit of an A.R.B. team to Washington, "the majority of the differences were classified as being of insufficient significance to warrant special treatment." The residual items are now subject to Special Requirements set by each of the two countries. These Special Requirements are steadily being reduced in number.

The divergence between British and American performance requirements has also been narrowed by the American decision to recast their requirements for turbine-engine aircraft in a new form close to the British model. At a meeting held last December "it became quite clear that there was a very good prospect of obtaining substantial uniformity of the two performance codes." Subsequent meetings have further widened the area of agreement.

C.A.B. OVERRULED

A RECENT decision of the U.S. Court of Appeals has ruled against the C.A.B.'s authority to regulate airline depreciation obliges airlines to include spare parts and equipment as current assets. Previously labelled as fixed assets, these items could, under the new ruling, no longer be depreciated.

The Court of Appeals was not required to venture an opinion as to whether the earlier practice of depreciating equipment and parts was justified, but has merely held that the C.A.B. lacks authority to enforce a particular depreciation method.

No doubt this decision will bear on a related case soon to be considered by a lower court. This concerns the C.A.B.'s ruling that airframes should generally be depreciated over seven years.

The Board is expected to lodge a counter-appeal, insisting that they are entitled to prevent the airline industry from artificially inflating their published cost figures.

Placed at the start of the horseshoe-shaped final assembly line at Boeing's Renton plant is the first 707-320, destined for PanAm.

WEARING BLINKERS

IN a report prepared by I.C.A.O.'s Air Transport Bureau for their Council to consider at its recent meeting in Montreal, the suggestion was put forward that airliner capacity will exceed demand once the new jets have been delivered in quantity. The simple proposition was voiced widely two or three years ago by many outside observers of the airline industry who viewed aghast the airline industry's enthusiasm for re-equipment. The picture has not been altered substantially by the widespread recession now being experienced: what previously was considered to be a probability now appears to be a certainty.

But in accepting the study prepared by the Secretariat, I.C.A.O.'s 21-nation council had to overrule the views of the British and American delegates. Mr. J. Riddoch of the U.K. considered it misleading to associate excess capacity with jets, and suggested that this phenomenon could arise from over-ordering any type of aircraft. The U.S. delegate, Mr. Nelson David, based his opposition to publication of the report on the grounds that this would prejudice the airlines' financing plans.

WESTLAND'S ACT OF FAITH

AFTER a month's contemplation of the issues involved, the Ministry of Housing and Local Government has agreed to Westland's plan for developing a site at Battersea as a temporary helicopter station to serve London. This plan, as described in *Flight* of May 16, 1957 (the only major change being the addition of a second storey to the station buildings), entails the construction of a T-shaped concrete landing platform built on piles and jutting out into the river from a 200ft square "apron" alongside the riverbank.

Noise, a problem that has obstructed many past ventures in the field of heliport construction, presents no trouble as the industrial buildings bounding three sides of the helicopter station provide "a ready-made noise muffler." Furthermore, the level of local traffic and industrial noise is such that tests carried out by the National Physical Laboratory, using an unsilenced Whirlwind, showed that "the degree to which the general noise level was exceeded was negligible and of minimum duration."

Capital cost of the helicopter station is estimated to be £62,000, while annual costs will be no more than a few thousand pounds. Construction will start early in August and finish in December.

As no company (not excepting Westland) is to operate scheduled helicopter services into London in the immediate future, customers at the outset will be limited to charter operators. Westland are confident that charter services will increase once the Battersea heliport is in use, for many provincial municipalities have delayed construction of their own helicopter stations until facilities were available in London.

The proposal put forward by Rotorports, Ltd., for a floating platform moored opposite the Tate Gallery was turned down by the Minister, mainly on the grounds of noise interference, inadequate facilities and access difficulties.

NEW NAVIGATION EQUIPMENT

PRELIMINARY details have been released by General Precision Equipment Corporation of their HIDAN navigation equipment. It consists of the G.P.L. Radan Doppler radar, the J-4 gyro-magnetic compass, a timing device and a small computer indicating deviation from a pre-set track; and it is offered as a self-contained aid to accurate route flying for airliners. A 3,000-word narrative document issued by the manufacturer gives these general details and states that HIDAN has been tested in the New York area in a DC-3.

DOVES IN FLORIDA

AN airline has been founded to provide intra-state feeder services within Florida from any point in that state to stations served by the major carriers. The new carrier, Southeastern Airways, Inc., have established their headquarters at Miami, and started operations with Doves.

Southeastern is closely associated with the Aviation International Corporation, the president of both companies being Robert M. Myer, Jr.

BREVITIES

RUSSIA'S first regular helicopter service is planned to start soon in the Crimea between Simferopol and Yalta, ten-seater Mi-4s covering the 30 mile journey in 21 minutes.

* * *

Air Algerie have taken up an option on a third Caravelle.

* * *

Admission of Indian Airlines Corporation to I.A.T.A. brings the number of members to 85 (including eight associates).

* * *

The Minister of Supply recently disclosed that the Fairey Rotodyne has reached a forward speed of 165 m.p.h.

* * *

Alitalia plan to start serving Pakistan and India this autumn. The new service, using DC-6Bs, will probably be extended to Japan and Australia next year.

* * *

Schiphol Airport is considering a 50 per cent increase in landing dues and a 25 per cent increase in runway lighting charges. K.L.M. accounts for three-quarters of Schiphol's traffic.

* * *

A Soviet-French air agreement signed last month provides for the start of a direct Paris - Moscow service in August. Tu-104s and Air France L.1649As will each operate two services weekly.

B.E.A. Viscount 802s and 806s were briefly grounded last week for an inspection concerning lubrication of the wing-flap mechanism.

* * *

Britannia 314s are to be introduced on to C.P.A.L.'s Vancouver - Tokyo - Hong Kong service in the latter part of August, by when all six Britannias should be delivered.

* * *

This year's Russian air display at Moscow will be limited to civil types and will include aircraft from other Communist countries.

* * *

The L. B. Smith Corp. of Miami has been authorized by Vickers-Armstrongs (Aircraft), Ltd., to handle Viscount repairs, conversions and modifications.

* * *

The M.T.C.A. symbol for an active land aerodrome will in future show a central dot indicating the presence of "a runway or strip, regardless of surface, of 6,000ft or more in length."

* * *

The British Government has reduced K.L.M.'s use of Singapore from three to two landings weekly. The Dutch were granted permission to use Singapore at the time of the evacuations from Indonesia.

CLUB AND GLIDING NEWS

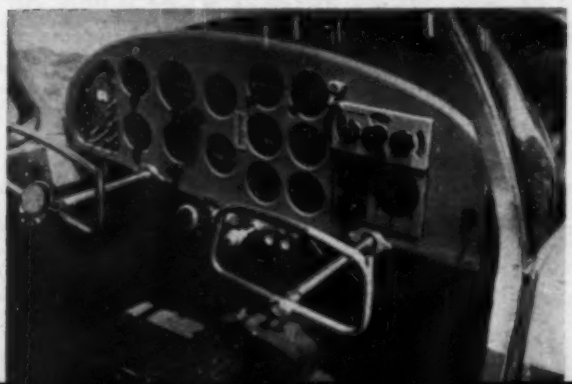
THREE days have been allotted this year to the National Air Races, which are to take place at Coventry on Thursday, Friday and Saturday, July 10, 11 and 12. During those days all three rounds of the Kemsley, Osram and Goodyear Trophy races will be flown, in addition to the King's Cup race, the Lockheed Trophy international aerobatic competition and an air display. The number of aircraft competing in each race has been increased to 14.

Thursday's programme, which begins at 1.30 p.m. and ends at 7.0 p.m., includes the first round of the three National Air Races and the preliminaries of the British Lockheed International Aerobatic Competition. Between 10.30 a.m. and 4.30 p.m. on Friday the second and third rounds of the Nationals will be flown and Saturday (from 11 a.m. to 6.0 p.m.) will be devoted to the King's Cup Air Race, the final of the aerobatic competition and the air display. Among the aircraft due to take part in the air races are the Arrow Active, Aeronca Champion, two Druine Turbulents, the Chilton D.W.1.a, a strong Tiger Club representation, two Jackaroos, the Mew Gull and Sparrowjet. A varied international entry, which this year will include Metasokol, Jungmeister, Stampe, Akrobat and Bishop, is expected for the aerobatics.

AFTER the air races, on July 13, Wolverhampton Aero Club and the Surrey Flying Club will be holding "At Homes" at Wolverhampton and Croydon airports respectively. As last year, Surrey Flying Club will be hosts to the Czech pilots competing in the Lockheed aerobatic trophy, and they anticipate a splendid flying programme, including an aerobatic demonstration.

THE Yorkshire Aeroplane Club at Sherburn quit its tenancy of Sherburn airfield on June 30. Mr. A. G. Wilson, a co-director of the club (which was closed for flying in March), said he had no idea if the Air Ministry—which owns the airfield—had any future plans for it. Some of the club's seven aircraft have already been sold and the remainder will be taken to Yeadon Airport and stored there until they can be disposed of. The decision to end the tenancy of Sherburn also affects the Yorkshire Gliding Club which has been flying from there.

The Y.G.C. will now return all its aircraft and equipment to its headquarters at Sutton Bank near Thirsk. If they find there is a demand for gliding nearer to Leeds, Bradford and other West Riding towns, they will look for an alternative site to Sherburn.



Black instruments on a grey background and grouped dials make the Nibbio's cockpit attractive as well as functional.

QUITE one of the smoothest four-seaters yet produced, the Italian Aviamilano Nibbio F.14 is now being offered for sale outside Italy at a basic price of $16,800 (about £6,000). Powered by a single Lycoming O-360 engine giving 180 h.p. and Hartzell constant-speed propeller, and carrying a useful load of 1,050 lb (four occupants, 45 Imp. gal fuel and 88 lb of baggage). The Nibbio will reach 205 m.p.h. on the level and normally cruises at 189 m.p.h. at 2,400 r.p.m. Range is 620 miles. Minimum landing and take-off runs are both below 200yd; and stalling speed with power on and gear and flaps down is 51 m.p.h. Gear and flap extension speeds are respectively 124 m.p.h. and 112 m.p.h.; and endurance speed is 160 m.p.h. Normal category C.A.R.3 certification is expected soon. At 190 m.p.h., specific range is 20 air miles/Imp. gal.

Following tradition established by the excellent little Falco F.8, Nibbio structure is all-wood, with plywood skin covered in fabric and high-gloss dope, the whole being treated to resist tropical climates. At full load, the ultimate load factor is 7. The wing has a laminar NACA 64000 series section with a t/c ratio of 13 per cent at the root and 10 per cent at the tip. Wash-out is 4 deg. Flap area is 17.1 sq ft, maximum extension being 45 deg. Undercarriage retraction is by electric screw-jack with manual standby; and the rudder pedals are connected to the nosewheel for steering on the ground. In addition, hydraulic wheel-brakes can be differentially controlled from toe-pedals.

An Italian correspondent, Vico Rosaspina, reports that the Nibbio is light and easy to fly. It can be trimmed hands-off at 1.3 Vsl and takes off at 65 m.p.h. Rate of roll is 120 deg/sec at cruising speed and 80 deg/sec at 85 m.p.h. with everything down. The stall is heralded by buffeting some 10 m.p.h. above stalling speed, the nose drops straight and the Nibbio tends to recover by itself. Minimum loss of height after stalling is only 110 ft. The power-on stall with everything down at 30-deg bank is 56 m.p.h. Normal approach and touch-down speeds are respectively 93 m.p.h. and 59 m.p.h.

There is seating for four people, with dual controls, in a cabin 7.5ft long, 3.6ft wide and 3.9ft high, while baggage is accommodated in a compartment accessible behind the rear seats and measuring 1.6ft × 3ft × 1.6ft. Entry is by a single wide, car-type door to starboard. Full blind-flying instrumentation, V.H.F. radio and A.D.F. can be accommodated.

As reported in *Flight* for June 6, Aviamilano have formed a team to take part in continental sporting rallies and to demonstrate both the Falco and Nibbio. The two aircraft should be on view at the Grand Prix de France being flown between La Baule and Deauville between July 15 and 18. Leading data of the Nibbio are:—

Span, 31.1ft; length, 25.2ft; wing area, 138.7 sq ft; aspect ratio, 7; empty weight, 1,500 lb; gross weight, 2,550 lb; wing loading, 18.4 lb/sq ft; power loading, 14.1 lb/h.p.; Vne, 250 m.p.h.; max. level speed, 205 m.p.h.; max. cruising speed at 2,450 r.p.m., 192 m.p.h.; stalling speed, clean, power off, 59 m.p.h.; take-off run, 590ft; climb at m.c. power, 1,200ft/min; service ceiling, 17,700ft.

Britain's Foreign Air Traffic

AIRLINES SHOULD OVERTAKE SHIPPING COMPANIES BY 1960

PUBLICATION of Board of Trade statistics for British overseas travel allows a closer picture to be drawn of passenger traffic flying to and from the United Kingdom in 1957.

OVER four million passengers flew between the United Kingdom and countries abroad in 1957. One million of these travelled to or from Eire or the Channel Islands. Of the other three million, just under two and a half million moved between U.K. and the Continent, while the remaining two-thirds of a million travelled the long intercontinental routes.

Continental traffic thus accounts for 60 per cent of the total, while that to and from Jersey, Guernsey and Eire accounts for 27 per cent—these percentages have remained fairly constant for the last few years. On a count of heads, intercontinental services in and out of the U.K. only account for one-sixth of total air traffic. However, when distance travelled is also taken into consideration a completely different picture emerges. The intercontinental routes are then seen to contribute two-thirds of the total passenger-mileage. European traffic is only equivalent to 30 per cent of the total, while the one million Channel Island and Irish Republic travellers are only equivalent to 200 million passenger-miles or 5 per cent of the total.

A striking feature of British air traffic is its long-haul character. Whereas the average distance flown per passenger for all scheduled services throughout the world is 585 miles according to I.C.A.O., that for passengers flying to and from the U.K. appears to be 930 miles, or almost double the published global average.

CONTINENTAL AND INTERCONTINENTAL AIR TRAFFIC, 1957

Country (in order of distance from the U.K.)	Average mileage (× 1,000)	Passengers by Air (×1,000)	(% of total)	Passenger-miles (×mill)	(% of total)
Holland	0.2	257	8	52	2
Belgium	0.2	155	5	34	1
France	0.3	823	27	246	7
Germany	0.4	286	9	100	3
Switzerland	0.5	295	10	145	4
Denmark	0.6	68	2	42	1
Norway	0.7	39	1	29	1
Spain	0.8	158	5	123	4
Austria	0.8	23	1	18	1
Sweden	0.9	33	1	30	1
Italy	0.9	175	6	159	4
Portugal	1.0	20	1	20	1
Below 1,000m.	0.5	2,442	79	1,110	31
Canada	3.5	115	4	378	11
U.S.	3.5	284	9	930	26
West Africa	3.8	37	1	141	4
East Africa	4.2	33	1	140	4
India/Pak.	4.7	43	1	202	6
Caribbean	5.0	17	1	86	2
Latin America	5.8	1	—	8	—
South Africa	5.8	14	—	81	2
Malaya	6.8	14	—	93	3
Australia	10.6	8	—	83	2
Over 1,000m.	3.8	653	21	2,471	69
Total	1.2	3,095	100	3,581	100

Much the most densely travelled air routes are those between France and Britain along which passes one in every five passengers. Next come the routes to Eire and to the Channel Islands, along each of which move half a million passengers a year. Coming well behind this are four routes—to Holland, Germany, Switzerland and the U.S.—each carrying rather more than a quarter of a million passengers annually. Graded in terms of passenger-miles, traffic between the U.K. and the U.S. is much greater than on any other route, and amounts to nearly one thousand million passenger miles (equivalent to one-quarter of all air traffic in and out of the U.K.). The U.K. - Canada route comes next in order of passenger mileage, contributing one-tenth of the British total. U.K. - Caribbean and U.K. - Latin America traffic appears to be slight because some of the former and most of the latter travels via New York and so is shown as U.S. traffic. If the direct mid-Atlantic traffic is added to the North American total it is seen that no less than 40 per cent of all air traffic in and out of the U.K. traverses the Atlantic.

The annual rate of traffic growth has varied between 15 and 20 per cent in recent years. The fastest rate of growth has been experienced not on the short cross-Channel crossings, nor on the intercontinental services, but on routes to the Mediterranean. Traffic from Britain to Italy and Portugal has doubled since 1954, while that to Spain has trebled. Traffic between U.K. and Scandinavia has also grown rapidly, having almost doubled since 1954. Of the more important European routes, that to France shows the slowest rate of increase over the last three years.

Unlike the Continental routes, the intercontinental routes show wide differences between the volumes of inbound and outbound traffic. While services between U.K. and Europe cater almost entirely for businessmen and tourists, those to countries farther afield carry an increasing share of migrants. The effect of this is seen particularly on inbound air traffic from the West Indies, and on outbound traffic to the U.S., Canada and Australia. Last year's figures indicate the size of this migrant traffic (to nearest thousand): West Indies, 11 inbound, 6 outbound; Canada, 44 inbound, 71 outbound; U.S., 127 inbound, 157 outbound. If allowance is made for immigrants, traffic on intercontinental routes is seen to have been increasing generally at a steady pace that in no case equals the meteoric expansion of the Mediterranean routes. The fastest growing intercontinental route, although still of relatively minor importance, is that between the U.K. and South Africa. Middle-East traffic has been stagnant for a number of years at about 20,000 passengers per annum in each direction, while Latin American traffic is shown as having fallen.

AIR TRAFFIC AS PERCENTAGE OF TOTAL TRAFFIC

Year	Europe	Eire	Channel Is.	Elsewhere	Average
1957	38	24	61	50	39
1956	36	22	58	42	36
1955	32	20	50	39	32
1954	31	19	47	36	30

The airlines have not only been carrying new traffic but also appear to have been diverting custom away from the shipping companies. Compared with the comfortable rates of traffic increase enjoyed by air carriers, the number of passengers carried by ship in and out of the U.K. has been increasing at only a few per cent annually. An increasing proportion of shipborne traffic (at present standing at 6¼m passengers annually) moves on the short cross-Channel crossings, for while traffic on these routes has been rising slowly (routes to Belgium have been expanding faster than those to France), the number of passengers using shipping services to the Channel Islands has tended to fall since 1955, and inbound sea traffic from points farther abroad than Europe has fallen steadily since 1955 (a fall in outbound intercontinental sea traffic has been prevented by the increase in immigrant traffic). Seen overall, on a passenger-mile basis the level of total shipping traffic in and out of Britain is probably fairly static. Against this, the rapid growth of air transport has led to a steady reduction in the proportion of traffic carried by sea, and if present trends continue, more people will be conveyed in and out of Britain in 1960 by airliners than by ships.

LONG-HAUL AIR AND SEA TRAFFIC

Country (in order of dist.)	Av. Distance (miles ×1,000)	Passengers (×1,000) Air	Sea	Total	Air Pass. as % of Total
Canada	3.5	115	164	279	41
U.S.	3.5	284	208	492	58
West Africa	3.8	37	20	57	65
East Africa	4.2	33	12	45	73
India/Pak.	4.7	43	19	62	70
Caribbean	5.0	17	20	37	46
S. Africa	5.8	14	64	78	18
Malaya	6.8	14	20	34	41
Aust./N.Z.	10.6	8	100	108	7
Total	3.8	653	667	1,319	50

Although journey distance is a factor in determining the degree to which air transport penetrates a particular route, the Board of Trade figures show this factor to be only one of many. Air services show poorly on the routes to the Irish Republic, capturing only 24 per cent of total traffic, while as much as 61 per cent of Channel Island traffic flew. The percentage penetration on continental services (primarily cross-Channel) and on Intercontinental services was 38 and 50 per cent respectively. This last figure contained wide variations, the penetration ranging from over 65 per cent in the cases of West Africa, East Africa, India, Pakistan and Ceylon, to less than 10 per cent in the case of Australasia.

By viewing the field of British traffic, two landmarks stand out prominently. The first is the increasingly long-haul character of today's air traffic, the second being the relatively untapped market for really long-haul air travel.

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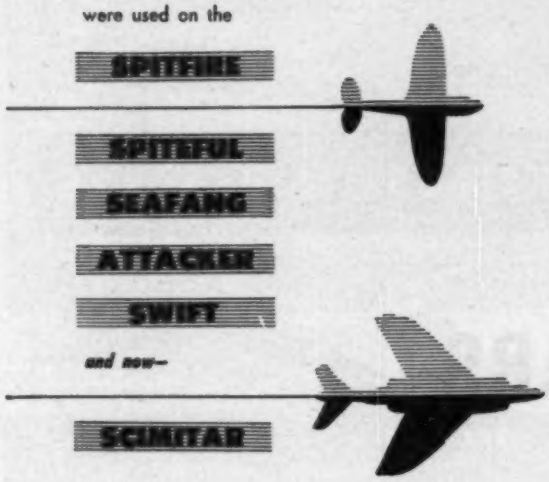

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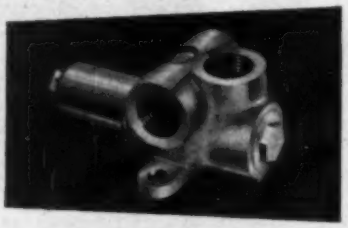

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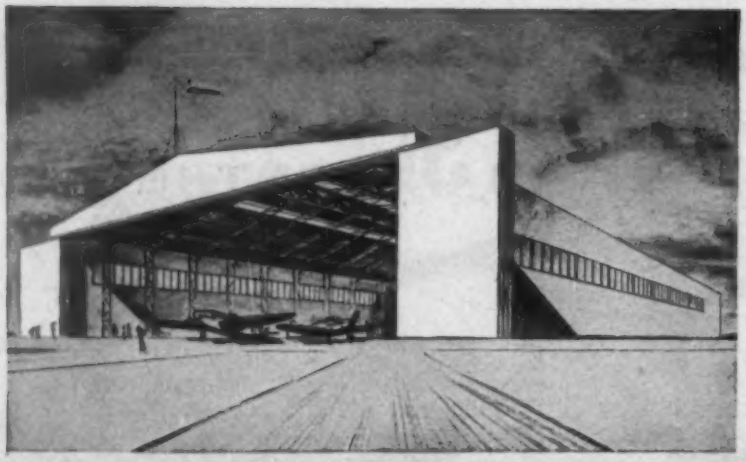

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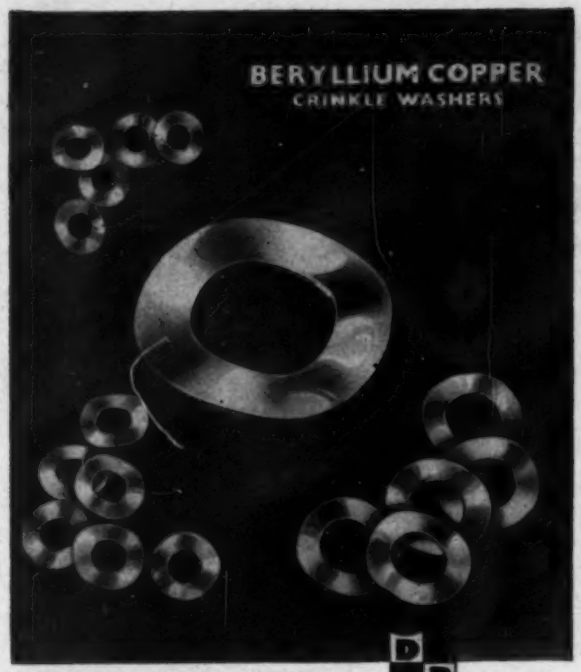

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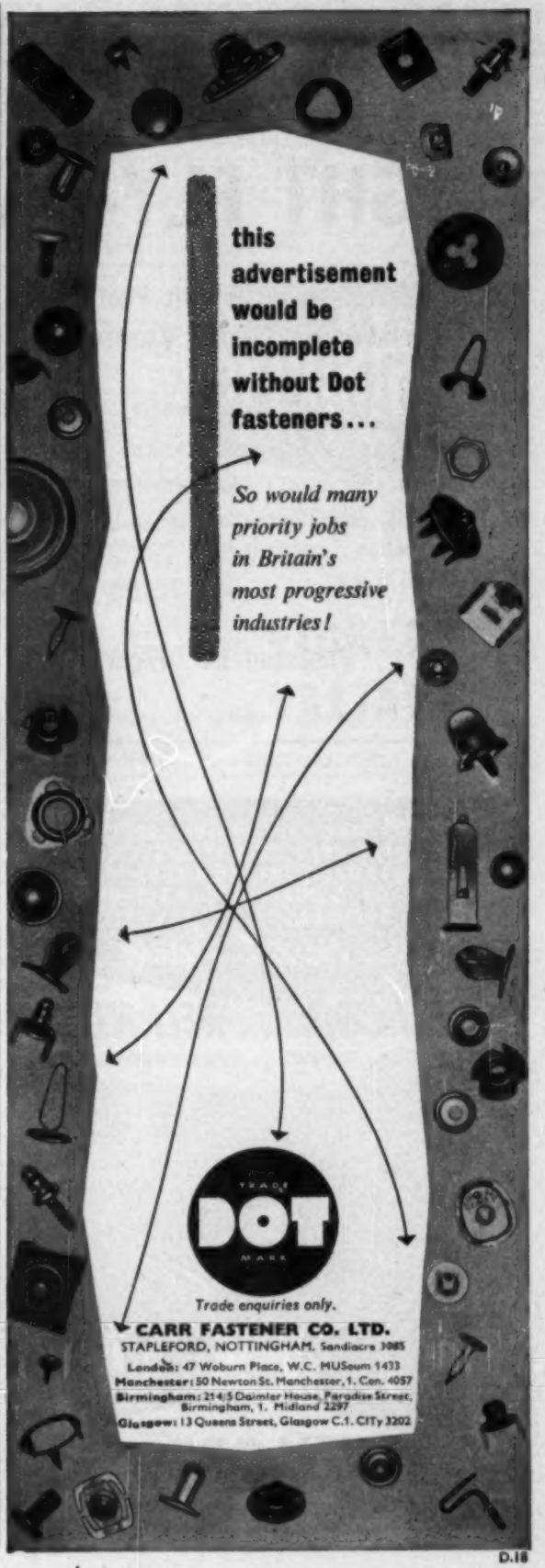
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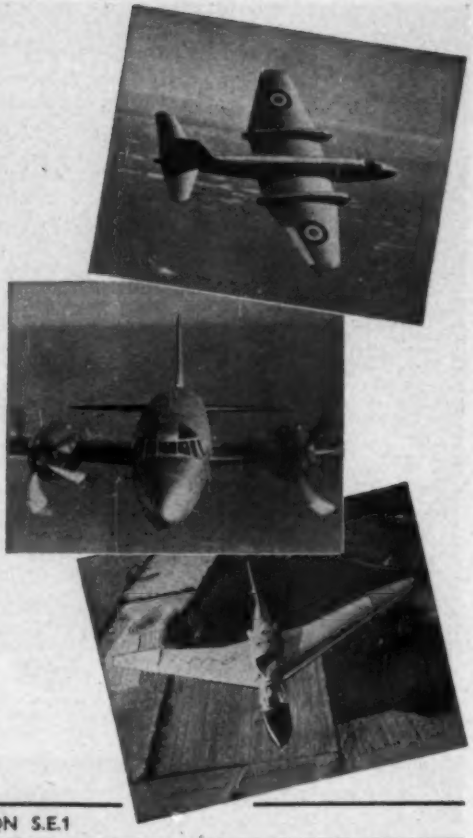

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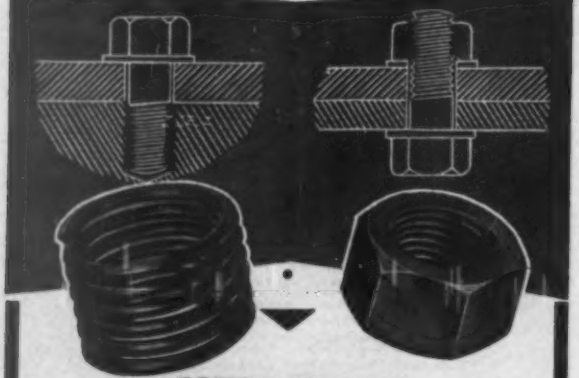

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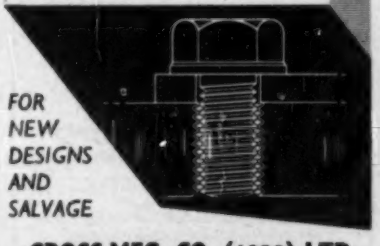

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AIR TRANSPORT ADVISORY COUNCIL

THE AIR TRANSPORT ADVISORY COUNCIL give notice that they have received the undermentioned applications to operate scheduled air services:

APPLICATION No. 1466/1 from B.K.S. Air Transport, Ltd., of 1 Marylebone High Street, London, W.1., for an amendment to the terms of approval of the Normal Scheduled Service which they are authorised to operate with Dakota, Viking and Elizabethan aircraft between Newcastle and Bergen at a frequency of two return flights weekly so as to permit them to include an optional traffic stop at Edinburgh.

APPLICATION No. 1785 from Dan-Air Services, Ltd., of 36/38 New Broad Street, London, E.C.2, for a seasonal U.K. Internal Service with Dakota and Bristol 170 aircraft for the carriage of passengers, supplementary freight and mail between London (Blackbushe) and Jersey at a frequency of three to four return flights weekly from June to September inclusive each year for seven years from June 1, 1959.

THESE applications will be considered by the Council under the Terms of Reference issued to them by the Minister of Civil Aviation on July 30th, 1952. Any representations or objections with regard to these applications must be made in writing stating the reasons and must reach the Council within 14 days of the date of this advertisement, addressed to the Secretary, Air Transport Advisory Council, 3 Dean's Yard, London, S.W.1, from whom further details of the applications may be obtained. When an objection is made to an application by another air transport company on the grounds that they are applying to operate the route or part of route in question, their application, if not already submitted to the Council, should reach them within the period allowed for the making of representations or objections. [8048

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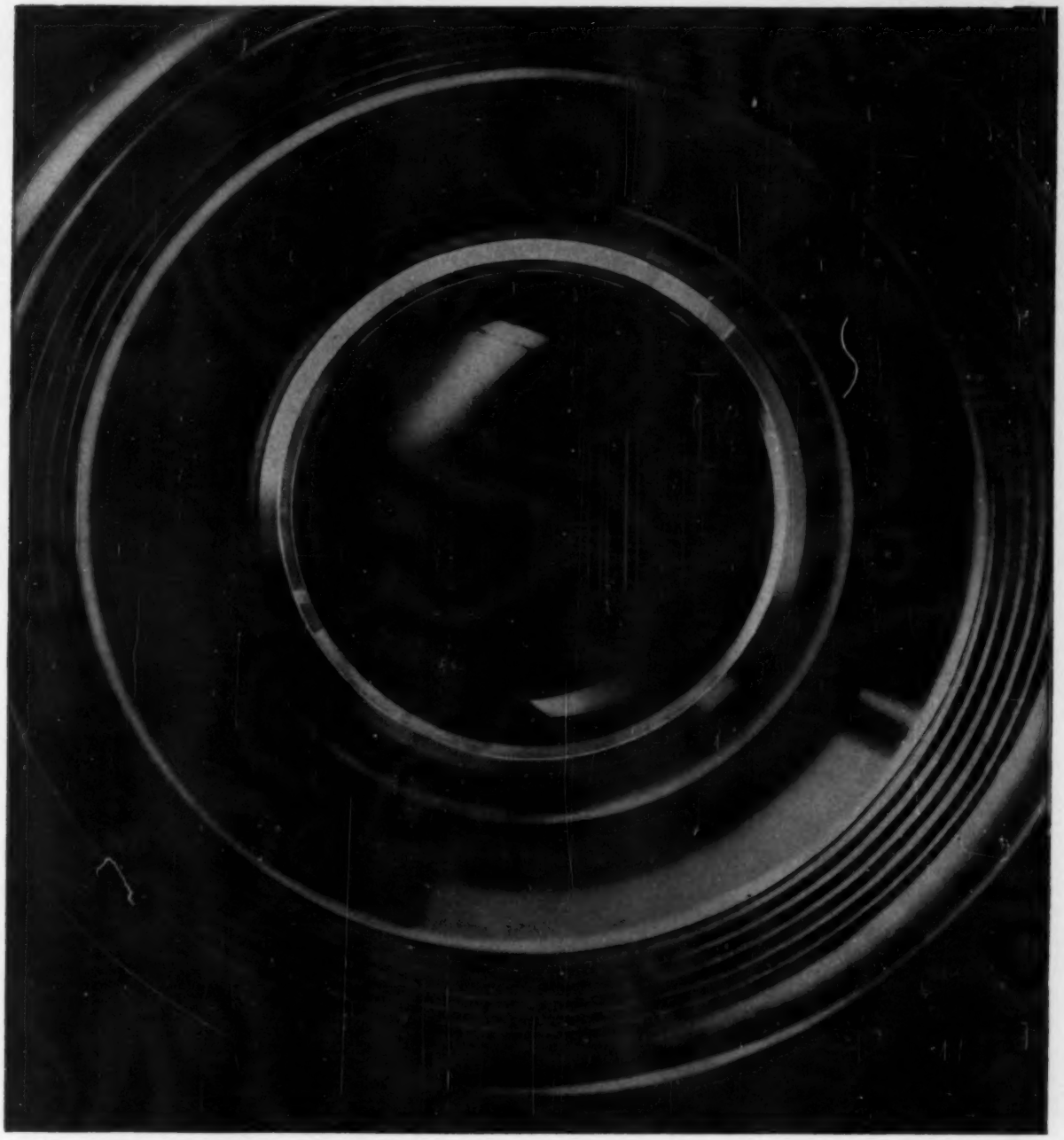

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